Queen's University

KINGSTON, CANADA

CALENDAR

OF

THE FACULTY OF APPLIED SCIENCE

(SCHOOL OF MINING)

THIRTY-FIFTH SESSION

1927-1928

Attention is directed to new regulations regarding the following:

Midyear Examinations.

Time Tables of Classes.

Queen's University

KINGSTON, CANADA

CALENDAR

OF

THE FACULTY OF APPLIED SCIENCE

(SCHOOL OF MINING)

THIRTY-FIFTH SESSION

1927-1928

KINGSTON
PRINTED FOR THE UNIVERSITY BY
HANSON & EDGAR.
1927.

1927/28

CALENDAR

1927

JANUARY

S	M	T	W	T	F	S
..	..	..	..	..	..	1
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FEBRUARY

S	M	T	W	T	F	S
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MARCH

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JULY

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SEPTEMBER

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OCTOBER

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NOVEMBER

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DECEMBER

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1928

JANUARY

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FEBRUARY

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MARCH

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APRIL

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MAY

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JULY

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AUGUST

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OCTOBER

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NOVEMBER

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DECEMBER

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16	17	18	19	20	21	22
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CALENDAR

1927.

July 15, Friday—Last day for applying for September examinations at the University or outside centres; or for exemption from these examinations or for degree.

Aug. 24, Wednesday—Shop Work for Courses F. and G. begins.

Sept. 3, Saturday—Supplemental Pass Examinations begin.

Sept. 20, Tuesday—Registration of First Year Students. Late fee after this date.

Sept. 21, Wednesday—Classes of First Year open at 8 a.m.

Sept. 21, Wednesday—Registration of Second, Third and Fourth Years. Late fee after this date.

Sept. 22, Thursday—Classes of Second, Third and Fourth Years open at 8 a.m.

Sept. 30, Friday—Last day of registration (with extra fee) of students in Applied Science who have not previously obtained from the Faculty permission to register later.

Dec. 15, Thursday—Mid-year examinations begin.

Dec. 22, Thursday—Christmas holidays begin at noon.

1928.

Jan. 4, Wednesday—Classes re-open (2nd term) at 8 a.m.

March 15, Thursday—Last day for receiving applications and fees for graduation.

April 2, Monday—Last day for receiving manuscripts and essays for prizes

March 31, Saturday—Classes close at noon.

April 4, Wednesday—Examinations begin.

April 6, Friday—Holiday (Good Friday).

April 28, Saturday—Meeting of Faculty to consider reports of examiners.

May 2, Wednesday—Convocation for distributing prizes, announcing honours and conferring degrees.

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A. B. Turner, B.A.[6] ..... Hamilton

1Elected by the University Council for three years.
2Elected by the Benefactors for four years.
3Elected by the Graduates for three years.
4Elected by the Board of Trustees to represent the Faculty of Applied Science for three years.
5Elected by the Board of Queen's Theological College for one year.
6Elected by the Board of Trustees for four years.
7Elected by Benefactors to represent the Faculty of Applied Science for three years.

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Retire 1932

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Retire 1933.

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W. T. MacClement, M.A., D.Sc. ..... Retires 1929
R. O. Jolliffe, M.A., Ph.D. ..... Retires 1930

The Faculty of Applied Science

E. L. Bruce, B.A., B.Sc., Ph. D. ..... Retires 1928
J. K. Robertson, B.A. ..... Retires 1929
W. P. Wilgar, B.Sc. ..... Retires 1930

The Faculty of Medicine

Thos. Gibson, M.A., M.B. ..... Retires 1928
D. C. Matheson, M.B. ..... Retires 1928
James Miller, B.Sc., M.D., D.Sc. ..... Retires 1928

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Alice Street

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Assistant Professor of Chemistry,
Sydenham Apartments

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233 Johnston Street

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372 Alfred Street

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***Instructor in Blacksmithing*: W. E. Connolly.**

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Electrical Engineering: H. J. Minter.
Mechanical Engineering: W. A. Richards.
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The administration of the University is vested in the Board of Trustees, the University Council, the Senate, and the Faculty Boards.

THE BOARD OF TRUSTEES

The Board of Trustees consists of *ex-officio* and elective members. The former are the Chancellor, the Principal and the Rector. The latter consists of (1) one representative from each affiliated college. (2) repre-

sentatives as provided for by the Statutes from (*a*) the University Council, (*b*) the Benefactors, (*c*) the Graduates, and (3) members elected by the Board of Trustees.

The functions of the Board of Trustees are to manage the finances, to possess and care for the property, to procure legislation, to appoint instructors and other officers, and in general to attend to such external matters as do not relate directly to instruction.

THE UNIVERSITY COUNCIL

The University Council consists of the Chancellor, the Trustees, the members of the Senate, and an equal number of members—graduates or alumni—elected by the graduates.

The Chancellor is elected by the Council, except when two or more candidates are nominated, in which case the election is by registered graduates and alumni. He holds office for three years; and, as the highest officer of the University, presides at meetings of the Council, at Convocation and at statutory meetings of the Senate. In his absence he is represented by the Vice-Chancellor.

The Functions of the Council are:

(1) To elect six trustees, two of whom shall retire annually.

(2) To make by-laws governing the election of (*a*) the Rector by the registered students, (*b*) seven trustees by the benefactors, (*c*) six trustees by the University Council, and (*d*) six trustees by the graduates.

(3) To discuss all questions relating to the University and its welfare.

(4) To make representation of its views to the Senate or the Board of Trustees.

(5) To decide on proposals for affiliation.

(6) To arrange all matters pertaining to (*a*) its own meetings and business, (*b*) the meetings and proceedings of Convocation, (*c*) the installation of the Chancellor, and (*d*) the fees for membership, registration, and voting.

The annual meeting of the Council is held on the Tuesday immediately preceding Convocation.

THE SENATE

Until 1913 the Senate was composed of all the Professors, Associate Professors, and Assistant Professors on the staff of the University. It transacted all business relating to the work of instruction, the arrangement of classes, the conduct of examinations, and the award of standing, having charge in general of the internal administration of the University.

In 1913, however Faculty Boards were created to relieve the Senate of much work which, owing to the growth of the University, had increasingly devolved upon it, and at the same time the Senate was made a representative body composed of certain members of the various Faculties.

The Senate now consists of:

The Principal.
The Vice-Principal.
The Principal of Queen's Theological College.
The Dean of the Faculty of Arts.
The Dean of the Faculty of Applied Science.
Three Professors elected by the Faculty of Arts.
Two Professors elected by the Faculty of Queen's Theological College.
Three Professors elected by the Faculty of Medicine.
Three Professors elected by the Faculty of Applied Science.

The Functions of the Senate are:

(1) To determine all matters of an academic character which concern the University as a whole.

(2) To consider and determine all courses of study leading to a degree, including conditions of Matriculation, on recommendation of the respective Faculty Boards; but the Senate shall not embody any changes without having previously presented these to the Faculty.

(3) To recommend to the Board of Trustees the establishment of any additional Faculty, Department, Chair, or Course of Instruction in the University.

(4) To be the medium of communication between the Alma Mater Society and the Governing Bodies.

(5) To determine all regulations regarding the social functions of the students within the University, and regarding the University Library and University Reading Rooms.

(6) To publish the University Calendar.

(7) To conduct examinations.

(8) To grant Degrees.

(9) To award University Scholarships, Medals and Prizes.

(10) To enforce the Statutes, Rules and Ordinances of the University.

(11) And generally, to make such recommendations to the Governing Boards as may be deemed expedient for promoting the interests of the University.

THE FACULTY BOARDS

The Faculty Boards are constituted as follows:

For the Faculty of Arts and for the Faculty of Applied Science, the Dean, Professors, Associate Professors, Assistant Professors, and Lecturers of each Faculty have power to meet as separate boards, and to administer the affairs of each Faculty under such regulations as the Board of Trustees may prescribe.

For the Faculty of Medicine, the Dean, Professors, Associate Professors, and Assistant Professors have power to meet as a separate board, and to administer the affairs of the Faculty under such regulations as the Board of Trustees may prescribe

The principal is *ex-officio* president and a member of each of the foregoing Faculty Boards. In his absence the Dean of the Faculty shall preside.

The Functions of the Faculty Boards are:

(1) To recommend to the Senate courses of study leading to a degree, and the conditions of admission.

(2) To decide upon applications for admission or for change of course, subject to the regulations of the Senate.

(3) To submit to the Senate names for both ordinary and honorary degrees.

(4) To arrange the time-table for classes and to edit the Faculty Calendar, subject to the approval of the Senate.

(5) To control registration, and determine the amount of fees and manner of payment, subject to the regulations of the Senate, and the approval of the Board of Trustees.

(6) To deal with class failures.

(7) To exercise academic supervision over students.

(8) To make such recommendations to the Senate as may be deemed expedient for promoting the efficiency of the University.

(9) To award Faculty Scholarships, Medals and Prizes.

(a) To appoint, within the limits of the funds made available by the Trustees, such sessional assistants, fellows, tutors and demonstrators as shall be needed to give instruction in the subjects taught by the Faculty.

(11) To pass such regulations and by-laws as may be necessary for the exercise of the functions of the Faculty.

HISTORICAL NOTE.

The School of Mining, now the Faculty of Applied Science, Queen's University, was founded in 1893 under an Ontario Charter which placed its management in the hands of a Board of Governors elected by its shareholders, i.e., the subscribers to its funds. While originally a Mining School it has been expanded to include courses of study for degrees in mining and metallurgy, in civil, mechanical, electrical and chemical engineering, in analytical chemistry and assaying, and in geology and mineralogy. The objects of the institution were to provide thorough instruction both theoretical and practical, in the above and other branches of applied science, and to adapt courses of study and methods of presentation to the conditions prevailing in Canada, so as to secure as nearly as may be a maximum usefulness to the country.

For several sessions all its Departments were housed in Carruthers Science Hall, which had been erected in 1889, but in view of the rapid success and increased requirements of the School, the Provincial Legislature in 1900 provided for its accommodation two large buildings, Ontario Hall for the Departments of Mineralogy, Geology and Physics, and Fleming Hall for the Departments of Civil, Mechanical and Electrical Engineering. More recently the Provincial Government erected Gordon Hall, which is entirely devoted to Chemistry; and, through the generosity of Professor Nicol and other graduates, Nicol Hall has been built for the accommodation of the class rooms and laboratories of the Department of Mining and Metallurgy. These changes permitted the Civil Engineering Department to move into Carruthers Hall, leaving room in Fleming Hall for the already overcrowded departments of Electrical and Mechanical Engineering.

From its inception the School of Mining was closely connected with the University. The students of the School of Mining received their degrees from the University and the graduates in Science enjoyed the same rank and privilege as other graduates in representation upon the University Council and in the election of University Trustees. The staff of the School of Mining constituted practically the Science Faculty of the University, some of its members being actively connected also with the Arts and Medical Faculties, and the Faculty being represented with other faculties on the Senate of the University.

The School of Mining was formerly under the control of a separate board of Governors, but in the year 1916 it became the Faculty of Applied Science of Queen's University.

Kingston is well situated as the seat of a college of engineering and applied science. Geology and mineralogy, two of the fundamental subjects of a mining engineer's education and also important in other scientific professions, are studied to best advantage where the minerals can be seen as they lie in nature, and where geological formations can be examined *in situ*. In a few hours a class of students can be taken by carriage to a region so rich in mineral species that about forty different kinds have been secured in an afternoon. There are several geological formations out-cropping within easy walking distance of the city. If to this be added the accessibility by a short railway journey, of mines in operation, it will be seen the opportunities for instructive demonstrations to classes in mineralogy, geology and mining are very numerous. The metallurgical works at Deloro, eighty miles from Kingston, are also open to our students. It is thus possible to give to the study of mineralogy, geology, mining and metallurgy, that practical turn which not only adds interest to the college course, but shortens the period between graduation and attainment of proficiency and confidence in professional work.

The variety of topographical features in the surrounding country affords the best of material for practice in all branches of surveying, including railway, topographic, hydrographic and land surveying. The main line of the Grand Trunk passes through Kingston, which is also a terminus of branches of the Canadian Pacific and Canadian Northern Railways. The Canadian Locomotive Works, which are the largest locomotive shops in Ontario, are within ten minutes' walk of the University, and are open to students for study and for assisting in engine testing and similar work. Kingston has two Dry Docks, one of which, the large Dominion Government Dock, is now under lease to the Kingston Ship Building Co., in whose yards steel construction can be practically studied. The locks of the Rideau Canal can be visited at Kingston Mills, six miles from the heart of the city. There are also several water powers within

easy distance, some of which are as yet awaiting development, while others can be seen in use at Gananoque (eighteen miles distant), at Trenton (sixty miles distant), and at other points. Students of civil, mechanical and electrical engineering thus have easy access to practical illustrations of their professional studies.

REQUIREMENTS FOR ADMISSION.

Candidates desiring to enter the Faculty of Applied Science should ***under no circumstances come to the University without having first submitted their certificates to the Registrar for a statement regarding their value.*** *Certificates should be in the Registrar's hands by September* 1.

I.—ADMISSION BY MATRICULATION.

The requirements for matriculation into the Faculty of Applied Science are as follows:

Part I. Pass Matriculation in the following subjects: ***English, Mathematics, British History, and any two of the following****: Latin, Greek, French, German, Spanish, Experimental Science (Physics and Chemistry) or Agriculture.*

Part II. Honour Matriculation in the following subjects: ***English,*** *Mathematics,* and either a *Language* or *Experimental Science.*

The pass standard is fifty per cent on each paper on both Pass and Honour Matriculation.

Note:—For Honour Matriculation in a Language or Experimental Science a candidate may substitute Pass Matriculation in one of the optional subjects not offered in connection with Part I.

Candidates who have full Pass Matriculation but have not passed in the exact subjects required for the Faculty of Applied Science may prepare for a B.Sc., course, by taking a specified year's work in the Arts Faculty, which shall include English 1, Mathematics 1, Physics 1, French A, or Latin A, (or French 1 or Latin 1.) and a fifth class selected from first year work but not including Geology, Mineralogy or Chemistry.

By special permission of the Senate and upon the recommendation of the Science Faculty, students over twenty-one years of age may be admitted to this preliminary year in Arts for the purpose of satisfying the Science Matriculation requirements.

The requirements of Part II above may be satisfied by correspondence work in the Arts Faculty if the language option is taken, provided that the candidate is eligible to register in that Faculty.

II.—ADMISSION BY EQUIVALENT EXAMINATION.

The following certificates are accepted for Pass Matriculation, (Part I), in the subjects which they cover.

Alberta	Grade XI.
British Columbia	Intermediate Grade with Science of Senior Grade.
Manitoba	Grade XI Engineering Matriculation.
New Brunswick	Class I.
Nova Scotia	Grade XI.
Prince Edward Island	First Class Teachers' License or Second Year Certificates from Prince of Wales College.
Saskatchewan	Second Class (Third Year High School)
Quebec	University School Leaving Certificate. Grade XI Diploma.

Any one of the following certificates will be accepted in place of Honour Matriculation in the same subjects if the required standing has been made in the subjects covered.

Alberta	Grade XII.
British Columbia	Senior Grade.
Manitoba	First Class.
New Brunswick	Grammar School.
Newfoundland	Associate Grade.
Nova Scotia	Grade XII.
Ontario	Upper School.
Prince Edward Island	Honour Diploma of Third Year, Prince of Wales College.
Saskatchewan	First Class. (Fourth Year High School).

NOTE.—A certificate from any school which is on the list of schools approved by any University or Technical College of recognized standing in the United States will be accepted as equivalent to matriculation examination *pro tanto*.

III.—ADMISSION TO ADVANCED STANDING.

A student who has already taken, in a University Arts or Science Faculty or in a recognized technical or military school, subjects included in a course in the Faculty of Applied Science will, on entering upon a course for the degree of B.Sc., be admitted to the year for which he is qualified.

A candidate for advanced standing must submit with his application a Calendar of the institution in which he has studied together with an official statement of the subjects passed and the standing made.

IV.—ADMISSION OF SPECIAL STUDENTS.

Students not proceeding to a degree may take any classes for which they are prepared. The work in all classes is so arranged that those who wish to study, either for scientific interest or for the improvement of their qualifications for any particular position, may profitably pursue their studies in the Faculty of Applied Science.

The Faculty will admit under this paragraph, as special students, only such candidates as are fitted to take part of the classes of a course. It will not admit as special students those whom, on account of previous poor records, it is no longer desirable to continue as regular students.

Prospective students under this section should correspond with the Dean of the Faculty of Applied Science in regard to the arrangement of such a course.

MEDAL.

The Governor-General's medal is awarded each year to the student of the graduating class making the highest standing in the third and fourth years. A candidate to be eligible must write on all the examinations of the fourth year.

FELLOWSHIPS

1. Applications for Fellowships will be received by the Registrar up to May 1st. If no appointment is made by that date further applications will be received up to September 1st.

2. Fellows shall be selected and the character of their work shall be determined by the Department concerned in consultation with the Dean. The University reserves the right to dismiss a Fellow whose work is not satisfactory.

3. A student appointed to a Fellowship shall carry on research work for the whole session and embody the results in a thesis. The research may take the form either of independent investigation or of assistance in an in-

vestigation carried on by some department. The Fellow may be required to undertake tutorial work not to exceed six hours a week.

4. The income of the Fellowship will be paid in five instalments, of which the last will be paid only after the thesis has been accepted. A candidate for degree at the May Convocation must submit his thesis by April 30. Except by special permission, other Fellows must submit their theses not later than September 20.

The Milton Hersey Fellowship in Chemistry.

This Fellowship of the annual value of $500, has been endowed by Milton L. Hersey, M.Sc., LL.D., of Montreal. It is open to graduates of all universities and technical colleges.

SCHOLARSHIPS AND PRIZES

Exhibition of 1851 Science Research Scholarship.

This scholarship, of the annual value of £250 stg., is awarded by Her Majesty's Commissioners for the Exhibition of 1851 to students who have given evidence of capacity for original research, and are under 26 years of age. A given number of scholarships are awarded annually to students in Canada recommended by the Universities approved by the Commissioners.

The nominee must be a British subject, must have been a bona fide student of science for three years, must have been a student of the University for a full year immediately before his nomination, must be a student of the University at the time of his nomination, and must pledge himself not to hold any position of emolument whilst holding the scholarship without special permission from the commissioners. He is recommended to the commissioners by the Senate of the University. The scholarship will be tenable ordinarily for two years and in cases of exceptional merit for three years. The scholar will, in the absence of special circumstances, be required to proceed to a country other than that in which he received his scientific training, and there pursue some investigation likely to promote technical industries or scientific culture. The particular investigation the student proposes to pursue must be stated before a scholarship can be awarded.

Students of the Faculty of Applied Science are eligible for this scholarship.

The 1851 Science Research Scholars from Queen's University are the following:—

Norman R. Carmichael, M.A., 1893-4.
Thomas L. Walker, M.A., 1895-6.
Frederick J. Pope, M.A., 1897-8.
Wm. C. Baker, M.A., 1900-1.
C. W. Dickson, M.A., 1901-2-3.
C. W. Knight, B.Sc., 1904-5.
F. H. MacDougall, M.A., B.Sc., 1905-6.
C. Laidlaw, B.A., M.D.,, 1907-8.
N. L. Bowen, M.A., B.Sc., 1909-10.
Walter A. Bell, B.Sc., 1911-12.
J. R. Tuttle, M.A., 1913-14.
R. C. Cantelo, B.Sc., 1915-16.
D. G. H. Wright, B.Sc., 1921.
R. H. F. Manske, M.Sc. } 1924.
Donald C. Rose, M.Sc., }

Scholarships are tenable in the session following their award. By special permission of Faculty, the recipient of a Scholarship, available in the third and fourth years of his course, may postpone the use of the Scholarships for one year in order to engage in practical work connected with his chosen profession.

The Kenneth B. Carruthers Scholarships in Mining and Metallurgy—Value $137.50 Each.

Given in memory of Major Kenneth B. Carruthers, B.Sc., who was killed at Passchendale in October, 1917. Two scholarships are awarded annually on the results of third year work, one to the student in Mining and Metallurgical Engineering (Course A) and the other to the student in Chemical and Metallurgical Engineering, Metallurgical option, (Course D) making the highest standing in the whole year's work.

The P. D. Ross Scholarships.

Two scholarships of the value of $100 and $50 respectively. These scholarships are awarded annually to the students obtaining highest and second highest standing in the subjects common to the courses of the second year.

Robert Bruce Scholarships.

Under provisions of the will of the late Robert Bruce of Quebec the University has established a Scholarship worth about $75 in each of the Faculties of Arts, Applied Science, and Medicine. Until 1948 the award is limited to students of Scottish extraction.

The Scholarship in each Faculty will be awarded at the end of the first year to the student who has made the highest standing on the regular examinations of that year. One third of the value of each Scholarship will be

paid to the winner in each of the second, third, and fourth years of his Course provided that he is in attendance in the Faculty in which the award was made.

The Sir Sandford Fleming Practical Science Scholarship.—Value $70.

Given by the late Chancellor of the University, Sir Sandford Fleming, C.E., K.C.M.G., LL.D. Awarded to the student of the Faculty of Applied Science obtaining the highest average on the examinations at the end of the first year.

The N. F. Dupuis Scholarship.—Value $60.

This scholarship has been founded by the graduates as a mark of their appreciation of the long and effective services of Dr. N. F. Dupuis, as Dean of the Faculty and Professor of Mathematics. The scholarship is of the value of $60, and is awarded to the student who makes the highest marks in Mathematics of first year at the April Examinations.

The A. E. Segsworth Prize.—Value $50.

This is a prize founded by R. F. Segsworth, Esq., Toronto, in memory of his brother, A. E. Segsworth, B.A., Ph.D. The prize is awarded to the student of any year who hands in before December 1st the best account of his previous summer's experience in practical underground mining.

The Dr. William Moffat Scholarship.—Value $50.

This scholarship has been founded by Dr. William Moffat, of Utica, and is awarded annually to the student making the highest standing in first year chemistry. The award will be made on combined results of class work and examination and students in both Arts and Science will be eligible.

The E. T. Sterne Prize in Chemical Engineering—Value $25.00

To be awarded a student in Chemical Engineering at the end of his third year, for the best essay describing his summer work. Essays to be handed in by October 31st. The donor desires that emphasis be laid on a discussion of the theoretical principles in Chemistry and Physics underlying any one of the manufacturing processes described.

Prizes of The Canadian Institute of Mining and Metallurgy.

Premiums and prizes at the discretion of the Council, may be given annually for papers read by student-members of the Institute and affiliated students during the year. Any such award shall be made by the Council within three months after the Annual Meeting.

Engineering Society Prizes.

The Engineering Society of Queen's University offers two prizes of $15.00 and $10.00 for the two best papers on scientific subjects, by members

of the society. These papers must be read before the society, and five papers, at least, must be presented before the prizes will be awarded. These prizes are open for competition to all students of Engineering.

The Douglas Tutorships.

At the beginning of session 1910-11 a gift from Dr. James Douglas, of New York, led to the establishment of a system by which first year students were tutored by men selected from the senior years. The instruction is given out of class hours and as each tutor gives his whole attention to not more than five students in a period, the result is that of individual teaching.

REGULATIONS

N.B.—Students taking a regular course are subject to all rules and Regulations immediately upon publication, unless otherwise specified.

The Faculty may at any time, either during the term, or after the close of the term, require any student to withdraw from the University whose conduct, attendance, work or progress is deemed unsatisfactory.

1. Registration.—Students of first year must register and pay fees on the day before the opening of session. Students of other years will register and pay fees on the first day of session. A student who fails to register at the prescribed time must pay an additional fee of $3.00. No student proceeding to a degree will be allowed to register after the tenth day of the session except by special permission of the Faculty, *which permission must be obtained before the opening of session.*

2. Attendance.—Students are required to attend seven-eighths of class lectures before permission will be given to write on examinations, and seven-eighths of laboratory hours before laboratory work will be certified. Exemption from this rule can be obtained only on application to the Faculty.

3. Courses.—All students must take the subjects required in their courses in conformity with the calendars of their years of attendance. If a student wishes to change his course he must first obtain the permission of the Faculty.

4. Sessional Examinations.—Sessional examinations are held in all the subjects prescribed in the various courses. Fifty per cent. is required in each subject for pass standing. In determining a student's standing at a sessional examination, professors are empowered to take into account his entire class record.

Regular students must take the April examinations in all subjects in which they are registered and in which such examinations are held. Failure in more than four classes, including practical classes in which no written examinations are held, involves the loss of the session. A student failing in not more than four classes is given supplemental examinations in the following September; if he fails in more than one of these examinations he

may not proceed to the next higher year but must repeat a year's work, the time-table for which will be drawn up by a committee. If a student repeating the work of any year fails in classes enough to involve the loss of the year he must withdraw. A student shall not enter the third year until he has passed all the examinations of the first year; nor the fourth year until he has passed all the examinations of the second year. Engineering Field Work I. is regarded as a second year class and comes under this regulation both in respect to back classes and to admission to the fourth year. A student who is debarred from entering the third year because of back classes in the first year, or from entering the fourth year because of back classes in the second year, shall not be allowed to write on subsequent examinations in these classes without special permission from Faculty.

5. Mid-Session Examinations.—Examinations are held for first and second year students in all subjects the week before Christmas vacation. Any first year student failing in more than three of these examinations is refused admission in the following spring term, a proper refund being made on fees paid.

Examinations will be held in December in all classes of the third and fourth years which are not offered in the second term.

The Mid-year examination in all subjects in which the instruction terminates at that time are final examinations, and no other papers will be set in these subjects until the following September.

Supplemental Examinations.—Unless specially excused by the Faculty, upon application received at the Registrar's office before July 15, all students who fail in one or more subjects of their year up to a total of four must write supplemental examinations in all such subjects in September of the same year as a condition of admission to the next higher year of their course.

A student who has not been registered in the session in which he wishes to write on any supplemental examinations must pay the registration fee of $10 in addition to the examination fee.

Students may write on September examinations at approved outside centres but application must be made by July 15th to the Registrar.

6. Practical Work.—Students are required to take the practical courses given in the calendar unless they have followed similar courses in other educational institutions, but instructors may, at their discretion, modify the work in the case of students who have had experience in the field, in engineering works, etc. Such students may be set immediately at more advanced work than that required of those who have not had such experience.

7. Excursions.—The excursions are compulsory for all fourth year students in courses A. D. E. F. and G., and third year students in course B.

8. Vacation Work.—Before applying for a degree a candidate is required to submit certificates of having had at least six months' employment of a nature that in the opinion of the departments concerned shall have given him suitable experience in the practice of his profession.

9. Graduation.—Applications for degree must be made before March 15 on forms supplied by the Registrar.

10. Graduation with Honours.—Honour standing will be given to any student who graduates with an average of seventy-five per cent. or upwards upon the whole of the fourth year work in his course. Credit for Honour standing will be given on the diploma and in the list of graduates a mark of distinction will be placed with the names of those graduating with Honour standing.

FEES

Full Fees For a Course.

Students will pay upon registration the Tuition Fees indicated below and in addition the charges for Deposit and Student Interests.

When fees are paid in instalments, the first payment must be increased by the amount of the deposit required, and the fees for student interests.

Tuition (including class fees, registration, and December and April Examinations).

If paid in full before the first day of session $130 00

If paid in instalments:

1st payment, on registration 70 00

2nd payment, on or before January 6 ..... 65 00

Fifth Year in Commerce.

If paid in full by September 22 ..... 70 00

(This year is taken in the Faculty of Arts under regulations of that Faculty.)

Deposits (see under Deposits below).....$5 to $15

Student Interests—(Health insurance, $4; Athletics, $5; Special Fee to apply on Rink debt $3; Engineering Society, $2.50).....$14 50

Deposits.—For covering expenses of breakages, etc., a first year student must deposit $5 with the Treasurer. If at any time the amount of breakages, etc., exceed $3, an additional deposit of $5 must be made.

For second, third and fourth years the deposit is $5 except in the following courses:—

Second Year Courses A, B, C, D,	$10 00
Third Year Courses A, and Dm.	10 00
Third Year Courses B and Dc.	15 00
Fourth Year Course B.	15 00

Charges will be made for the use of platinum, and specially expensive chemicals and apparatus. All money to the credit of the depositors will be returned at the end of the session on presentation of the deposit receipt properly certified.

The fees below are payable as they are incurred.

Special Charges.

Pro tanto allowance of courses	$10 00
Late registration. See Regulation 1	3 00
Supplemental Examination, one subject	10 00
Each additional subject	2 00
Writing at outside centre in April (if permitted)	5.00
Late application for supplemental examination or graduation	3 00

Fees for Single Classes.

Registration	10 00
Examination	10 00
Student Interests	14 50
Any course of lectures	12 00
Drawing, One Course, per Session	12 00
Surveying, One Course, per Session	12 00
Assaying Laboratory, per Session	5 00
Chemical Laboratory, per Session	15 00
Petrographical Laboratory, per Session	5 00
Mechanical, Electrical or General Engineering Laboratory, per Session	15 00

Fees for M.Sc. Work.

Registration	$10 00
**Tuition (including examination)	50 00
Student activities	14 50
*Laboratory fee	10 00
Laboratory deposit	10 00
	$94 50

*Additional charges may be made in the case of students requiring special material and apparatus.

**If a student decides to spread his work over two years, he will pay each year $25 for tuition and the other charges mentioned above.

GRADUATION AND OTHER FEES

The Graduation Fee is payable before March 15. This fee is returned to unsuccessful candidates.

Extra fee for degree in absentia	$ 10 00
Graduation B.Sc.	20 00
" M.Sc.	20 00
Admission *ad eundem statum*	10 00

STUDENT SELF-GOVERNMENT.—All students are members of the Alma Mater Society, the chief instrument of student government, and are expected to share in its duties and responsibilities.

DEGREES.

I. Bachelor of Science.

1. The degree of B.Sc. will be given on the satisfactory completion of a four years' course in any one of the following departments:—

A. Mining and Metallurgical Engineering.
B. Chemistry.
C. Mineralogy and Geology.
D. Chemical and Metallurgical Engineering.
E. Civil Engineering.
F. Mechanical Engineering.
G. Electrical Engineering.
H. Physics.

A graduate in any course who desires to take the degree of B.Sc. in any other course, or a student desiring to change from one course to another, shall take all the classes which he has not already passed, in that course, or, by examination satisfy the Department in charge of those classes as to his knowledge of the subjects involved.

2. The degrees of B.A. and B.Sc. will be given on the satisfactory completion of a six years' course in Arts and Science according to the description, page 43.

A candidate for graduation must have completed either a four or a six years' course and have passed all the required examinations.

II. Master of Science.

The degree of Master of Science (M.Sc.) is granted to candidates who have graduated as B.Sc. and thereafter have spent at least one full session in attendance at the Faculty of Applied Science.

*The work prescribed will consist of two parts as follows:—

A. Research and Thesis representing not less than half the session's work. Except by special permission the thesis must be submitted by April 30. A candidate who is allowed to postpone must submit his thesis by September 20 if he desires a degree at the fall convocation.

B. One or both of the following which shall be cognate to the field of study and shall be tested by examinations.

(a) Prescribed lecture courses. These, however, shall be advanced courses.

(b) Directed special studies with reports.

Written examinations will be set on the lecture courses prescribed and also on the directed special studies and a minimum mark of 55%, must be made on each paper.

An oral examination will be given on the subject of the thesis.

Candidates must give notice of their intention to proceed to the degree of M.Sc. by October 15; they must satisfy the faculty of their fitness to proceed, and must have their programme of work approved by a committee consisting of the Dean, the Registrar and the Departments concerned.

Note.—For B.A. and M.A. courses in Chemistry, Physics, Mineralogy, Geology, etc., see Calendar of the Arts Faculty.

DOMINION LAND SURVEYORS.

The Degree in Mining or in Civil Engineering of Queen's University, Kingston, is equivalent to the "diploma as Civil Engineer" mentioned in Clause III. of the Dominion Lands Act; so that a candidate for D.L.S. having that degree from Queen's University is entitled to examination after one year's service with a D.L.S.

ONTARIO LAND SURVEYORS.

The Ontario Land Surveyors' Act, I. Geo. V., C. 41, S. 28.—"The privilege of a shortened term of apprenticeship shall be accorded to any graduate of . . . the School of Mining, Kingston,** in Civil Engineering, or in Mining Engineering, and such person shall not be required to pass the preliminary examination hereinbefore required for admission to apprenticeship with a land surveyor, but shall only be bound to serve under articles with a practising land surveyor, duly filed as required by section 32 of this act, during twelve successive months of actual practice, after which, on complying with all the other requirements, he may undergo the examination prescribed by this Act."

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*The Course for M.Sc., is a full session's work and cannot be done within the limits of the session by a candidate who is giving a large part of his time to other work.

**Now the Faculty of Applied Science of Queen's University.

COURSES.

A. Mining and Metallurgical Engineering.
B. Chemistry.
C. Mineralogy and Geology.
D. Chemical and Metallurgical Engineering.
E. Civil Engineering.
F. Mechanical Engineering.
G. Electrical Engineering.
H. Physics.

First Year, All Courses.

	Lect. Hrs. per week.	Lab. Hrs per week.	Page.
English	2	0	45
Mathematics I.	2a, 1b	2	47
Mathematics II.	2a, 1b	0	47
Mathematics III.	2b	0	47
Mathematics IV.	2a	0	48
Astronomy I	2b	0	49
Projection	0	2	98
Physics I, & II	4	2	50, 51
Chemistry I.	3	3	55
Drawing I.	0	5	97
Surveying I.	0	2	86
Physical Drill	0	2	99

Second Year.

Courses A, B, C, D.

Mathematics V.	3	0	48
Descriptive Geometry	0	5a	98
Physics III.	2	2	51
Physics IV. (a)	1a	2a	51
Qualitative Analysis II.	2	6	57
Mineralogy I.	1	2	67
Geology I.	2	0	63
General Engineering I.	2	0	79
Surveying III.	1	3	86
Drawing II.	0	5b	97

Courses E, F, G,

Mathematics V	3	0	48
Astronomy II.	1	0	49
Descriptive Geometry	0	5a	98
Physics III	2	2	51
Physics IV	1	2b	52
Qualitative Analysis I.	1	2	56
General Engineering I	2	0	79
Mechanical Engineering IX.	1	2	93
Surveying II.	1	3	86
Drawing III.	0	2a 5b	98
Shop Work	0	3	96

A.—MINING AND METALLURGICAL ENGINEERING.

This course is necessarily a very broad one, so that it may give a foundation for whatever branch of these professions a graduate may follow. Experience has shown that graduates do not usually follow any narrow differentiation which they make during their course, but are governed by many other factors in the practice of Mining and Metallurgical Engineering. These factors are often out of their control, and the wisest plan in a four years' course appears to be, not to specialize, but by a broad training, in the final years, to obtain a suitable introduction to any branch of the work.

There are, however, some well known avenues towards professional work, such as a good training and a manipulative skill in drafting, chemical analysis, and surveying. These subjects are common, and imperative, to almost any professional position in mining and metallurgy, therefore, they are perfected as far as is possible while at college.

At the present time there are no summer classes, or summer field work in mining or metallurgy. Under these conditions the student can, usually, obtain practical and remunerative work, during four or five months each summer. This work, if in connection with Mining, Metallurgy or Surveying is considered to be more useful as a training than practical work under academic supervision.

Visits are paid to mines and smelters. One trip at least is required of each student, the expense not to be more than twenty-five dollars.

FIRST AND SECOND YEARS.

See Page 31

THIRD YEAR.

	Lect. Hrs. per week	Lab. Hrs. per week.	Page.
Quantitative Analysis I.	1	3	58
Mineralogy III.	2a	0	68
Mineralogy IV.	1	2	68
Geology III.	1a, 2b	2b	64
Mining I.	1a, 2b	1a	69
Ore Dressing	1a, 2b	0	72
Metallurgy II.	2	0	74
Thermodynamics I.	2a	0	94
General Engineering V.	1	2	80
General Engineering III.	0	2	80
Electrical Engineering I.	2	2	87
Surveying V.	1a	3a	87
Fire Assaying	1b	3b	76

FOURTH YEAR

	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Industrial Chemistry I.	1	0	60
Mechanical Engineering IV.	2a, 1b	0	92
Geology V.	1b	0	64
Geology VIII.	2a, 3b	0	65
Hydraulics I.	2	0	82
Metallurgy IV.	3	0	74
Milling	0	10	72
Mining II.	3	0	70
Mining III.	0	6	71
Economics	2	0	46
Summer Essay			76

B.—CHEMISTRY.

This course is designed to fit men for the profession of expert chemists, teachers of chemistry, specialists in all lines of industrial professions where chemistry serves as the basis of the industry.

The great need for men well equipped for the profession of chemist is shown in the increasing demands coming to all universities for such men. Graduates are fitted to do constructive work in research laboratories and in industrial plants.

FIRST AND SECOND YEARS.

See Page 31

THIRD YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Quantitative Analysis II.	2	9a 6b	58
Industrial Chemistry II.	2	3	60
Physical Chemistry I.	2	3	59
Organic Chemistry I.	2	3	57
Inorganic Chemistry II.	1	0	56
Physics XIV.	0	2a	54
Metallurgy II.	2	0	74
Bacteriology	0	3b	62
German	3	0	45

FOURTH YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
General Chemistry III	2	3a	56
Colloid Chemistry Ib.	0	3b	61
Organic Chemistry II.	2	6	57
Physical Chemistry II.	2	3	59
Physical Chemistry IIIb.	2b	3b	59
Industrial Chemistry IIIa.	2a	3a	61
Economics I.	2	0	46
German	3a	0	45
Reports and Essays	0	2	62
Option in Chemistry			
General and Inorganic Chemistry IV, Organic Chemistry IV, Quantitative Analysis IV, Physical Chemistry IV or Industrial Chemistry IV.	0	3a, 6b	56-62

C.—MINERALOGY AND GEOLOGY.

This course is designed to meet the requirements of students who desire a theoretical and practical knowledge of the constitution and history of the Earth. It furnishes a foundation for the professions of mineralogy, geological surveying, mining and consulting geology, and is useful for those who will in any way be connected with the discovery or the development of the mineral resources of the country. It forms a good preliminary course for the mining engineer who wishes to understand thoroughly the groundwork of his profession. Since a knowledge of chemistry is essential for proper comprehension of many mineralogical and geological phenomena, considerable stress is laid on this science in the earlier part of the course. The departments of mineralogy and geology are furnished with well equipped laboratories for the physical and chemical examination of minerals, rocks and ores, and also with collections of illustrative material. While field excursions are made during the session, students are advised to spend the summer vacations in practical field work.

FIRST AND SECOND YEARS.

See Page 31

THIRD YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Quantitative Chemistry I.	1	3	58
Physical Chemistry I.	2	3	59
Mineralogy II.	2b	0	68
Mineralogy III.	2a	0	68
Mineralogy IV.	1	2	68
Mineralogy V.	0	2	69
Geology II.	3	0	63
Geology III.	1a, 2b	2b	64
Ore Dressing	1a, 2b	0	72
Surveying V.	1a	3a	87
Reports	0	3	

FOURTH YEAR.

Geology V.	1b	0	64
Geology VI.	2	0	65
Geology VII.	0	2	65
Geology VIII.	2a, 3b	0	65
Geology X.	0	3	66
Mineralogy VI	2	0	69
Metallurgy II.	2	0	74
Mining IV	2a, 1b	0	71
Assaying	1b	3b	76
Biology	2a	0	
Economics I.	2	0	46
German	3	0	45
Advanced Analysis and Thesis	0	9	69

D.—CHEMICAL AND METALLURGICAL ENGINEERING.

In the construction and operation of chemical works and metallurgical plants the services of men who combine a thorough knowledge of chemistry with an education in engineering are required. The course in Chemical and Metallurgical Engineering gives a training along both these lines, including a grounding in a competent knowledge of those materials of construction and the special kinds of plants and processes which are in use in the works mentioned.

The first two years of the course are the same as those in the courses in Chemistry and in Mining and Metallurgy.

Specialization begins in the third year, part of the time in this year being devoted to the study of Chemistry or of Chemistry and Metallurgy and part to Civil and Mechanical Engineering. On entering the third year, students choose those optional subjects more especially relating to Chemical Engineering or to Metallurgy.

This specialization is continued in the fourth year, which enables students to pursue advanced work in Chemical Engineering, Metallurgy, and Chemistry.

Visits are paid to local and to at least one outside chemical or metallurgical works, attendance being required. Chemical Engineering Students make a trip in their fourth year. Metallurgy students are required to make only one outside trip, which may be that specified for course A. or Dc. The expense of the trip to each student is not over twenty-five dollars.

FIRST AND SECOND YEARS.

See page 31

THIRD YEAR.

Chemical Engineering, Dc.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Quantitative Chemistry I.	1	3	58
Physical Chemistry I.	2	3	59
Industrial Chemistry II.	2	3	60
Organic Chemistry I.	2	2a, 4b	57
Thermodynamics I.	**2a**	0	94
General Engineering V.	1	2	80
General Engineering III.	0	2	80
Electrical Engineering I.	2	2	87
Mechanical Engineering I.	**2a**	**0**	91
Mechanical Engineering III.	**0**	**3a**	**91**
Chemical Engineering I.	2b	0	77
Quantitative Chemistry I. Laboratory	**0**	**2b**	58

Metallurgical Engineering, Dm.

Quantitative Chemistry I.	1	3	58
Physical Chemistry I.	2	3	59
Industrial Chemistry II.	2	3	60
Thermodynamics I	2a	0	94
General Engineering V.	1	2	80
General Engineering III	0	2	80
Electrical Engineering I.	2	2	87
Mechanical Engineering I.	2a	0	91
Mechanical Engineering III	0	3a	91
Metallurgy II.	2	0	74
Metallurgy III.	1b	0	74
Ore Dressing	1a, 2b	0	72
Fire Assaying	1b	3b	76

FOURTH YEAR.

Chemical Engineering, Dc.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Physical Chemistry II.	2	3	59
Mechanical Engineering IV.	**2a, 1b**	0	92
Economics I.	2	0	46
Structural Engineering III.	1	3	82
Chemical Engineering II.	2	3	77
Chemical Engineering III.	1	6	77
Metallurgy II.	**2**	**0**	**74**
Ore Dressing	1a, 2b	0	72
Metallurgy Lab. I.	0	3b	76
Hydraulic Engineering I.	2	0	82
Shop Work	0	3a	96

Metallurgical Engineering, Dm.

Physical Chemistry II.	2	3	59
Mechanical Engineering IV	2a, 1b	0	92
Economics I	2	0	46
Metallurgy IV.	3	0	74
Metallurgy VI.	**1b**	0	75
Metallurgy V.	**1**	0	75
Metallurgy VII.	**0**	2	75
Metallurgy Lab. II.	0	3	76
Hydraulic Engineering I.	2	0	82
Milling	0	10	72
Mining IV	2a, 1b	0	71

E.—CIVIL ENGINEERING.

In this course the two main divisions of Civil Engineering, namely Surveying and Draughting, on the one hand, and Structural Design and Construction, on the other, receive full consideration. During the earlier years of the course a sound training along engineering lines is given in Mathematics, Physics, Mechanics and other allied subjects, which are essential to the proper education of an engineer. The student is also made familiar with the use of the various instruments, and by many hours of practical work in the field and draughting room, becomes skilled in the ordinary operations of Surveying. During the same period the foundation work for structural design is laid by courses of lectures in materials of construction, as well as by demonstrations and practical work in the testing laboratories. During the final years more highly specialized instruction and training are given

along the lines of the two main divisions, with particular regard to the economic conditions of modern construction. At frequent intervals excursions are undertaken to the quarries, cement works, brick kilns, bridges, railway structures, canals and graving docks, which are to be found within easy distance of Kingston.

FIRST AND SECOND YEARS.

See Page 31

THIRD YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Metallurgy I.	1	0	74
Thermodynamics I.	2a	0	94
General Engineering II.	2	0	79
General Engineering III.	0	2	80
General Engineering VI.	1	3	81
Geology IX.	2	0	65
Structural Engineering I.	1	3	81
Hydraulic Engineering I.	2	0	82
Surveying IV.	1	3	86
Municipal Engineering I.	2b	0	84
Railway Engineering I.	2a, 1b	3	83
Electrical Engineering I.	2	2	87

FOURTH YEAR.

Industrial Chemistry I.	1	0	60
General Engineering IV.	0	2a	80
Railway Engineering II	1	3	83
Municipal Engineering II.	2b	2	84
Municipal Engineering III.	1	1	84
Highway Engineering I.	2a	3a	85
Mechanical Engineering IV.	2a, 1b	0	92
Hydraulic Engineering II.	2	0	83
Hydraulic Engineering III	0	2b	83
Structural Engineering II.	2	5	81
Structural Engineering IV.	1	5	82
Economics I.	2	0	46
Engineering Economics	1	0	84

F.—MECHANICAL ENGINEERING.

The profession of Mechanical Engineering embraces the design, manufacture and operation of all classes of machinery, of power plants and manufacturing plants, as well as the executive management of industries. A four years' course therefore must be broad enough to give the student a thorough training in the fundamental principles, and any sub-divisions intended to train a student for any one of the many specialties only, seem unwise, and are impracticable on account of the lack of time.

The first two years are devoted to the study of the fundamental subjects of Mathematics, Physics, Chemistry and Mechanics, including experimental work in the various laboratories. Special attention is given to the subject of strength of materials, with practice in testing during the second and third years. The study of the steam engine and other forms of heat-engines, includes courses in Thermodynamics, Valve Gears, Governors and the Balancing of Engines. Instruction is given in Mechanism, Machine Design, Shop Work, and the fundamental principles of Electrical Engineering. Instruction in drawing extends over the four years, and gives a thorough drill in modern drafting room practice. In the more advanced courses of the fourth year the student is taught how to apply the general principles to the design and operation of special machinery, steam and gas engines, steam boilers and gas producers, and complete power plants; *i.e.*, each student is allowed to specialize as far as is practicable. The instruction in the laboratories is intended not only to familiarize the student with standard methods of testing, but also to teach him how to attack original problems.

The fourth year students are kept in touch with the local manufacturing concerns in order to familiarize them with modern power plant and shop practice

FIRST AND SECOND YEARS.

See Page 31

THIRD YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Mathematics VI.	2a	0	48
Thermodynamics I.	2a	0	94
Thermodynamics II.	1b	0	94
Thermodynamics V.	1	2	95
General Engineering V.	1	2	80
General Engineering III.	0	2	80
Electrical Engineering I.	2	2	87
Metallurgy I.	1	0	74
Mechanical Engineering I.	2	0	91

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Mechanical Engineering II.	2b	0	91
Mechanical Engineering III.	0	6	91
Shop Work	0	3	96
Hydraulic Engineering I.	2	0	82
Mechanical Engineering IV.	2a, 1b	0	92
FOURTH YEAR.			
Industrial Chemistry I.	1	0	60
Thermodynamics III.	2	3a	95
Thermodynamics IV.	0	6	95
Electrical Engineering VII	1	2	88
Mechanical Engineering V.....	3	6	92
Mechanical Engineering VI.	2a, 1b	0	93
Mechanical Engineering VIII.	0	3b	93
Mechanical Engineering XI.	2b	0	94
Hydraulic Engineering II.	2	0	83
Metallurgy VIII.	0	2a	75
Economics I.	2	0	46

G.—ELECTRICAL ENGINEERING.

The instruction in the first two years of the course in Electrical Engineering provides for a thorough training in the fundamental subjects of Mathematics, Physics, Chemistry and Mechanics, including suitable work in the various laboratories. Part of the time is devoted to elementary drawing and shop work. In the third year the work consists of an introduction to the general principles underlying all electrical work together with elementary laboratory work. Considerable time is devoted to the study of Thermodynamics together with more advanced Mathematics and Physics. The fourth year is devoted to the study of the theory and action of the main types of electrical apparatus, the design and operation of central stations, electric lighting, electric railways and power transmission together with a thorough grounding in the principles underlying the electron tube.

An important part of the work consists in the working out of problems such as are frequently met with in practical work. In this way the student is trained in the application of theory to the solution of practical problems.

Arrangements are made for occasional visits to electrical works.

The whole course is designed to give the student a thorough understanding of the general principles which constitute the basis of all electrical work, together with a knowledge of how these principles are applied in practice. No effort is made to give that intimate knowledge of practical details which experience alone can supply.

FIRST AND SECOND YEARS.

See Page 31

THIRD YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics VI. ..	2a	0	48
Mathematics VII. ..	2b	0	48
Physics V.	1	3	52
Thermodynamics I. ..	2a	0	94
Thermodynamics II. ..	1b	0	94
General Engineering V.	1	2	80
General Engineering III.	0	2	80
Electrical Engineering II.	2	2	88
Electrical Engineering III.	3	3	88
Mechanical Engineering I.	2	0	91
Mechanical Engineering II.	2b	0	91
Mechanical Engineering VII.	0	3	93
Metallurgy I. ..	1	0	74
Hydraulic Engineering I.	2	0	82

FOURTH YEAR.

Hydraulic Engineering II	2	0	83
Hydraulic Engineering III.	0	2a	83
Metallurgy VI. ..	1b	0	75
Thermodynamics III. ..	2	3a	95
Electrical Engineering V. . .	4	6	88
Electrical Engineering VIII. ..	1	3	88
Electrical Engineering XII	2	3b	89
Economics I. ..	2	0	46

One of the following classes:—

Electrical Engineering IX. ..	1	3	89
Electrical Engineering X. ..	1	3	89
Electrical Engineering XI.	1	3	89

H.—PHYSICS.

This course is designed to fit men for positions as physicists in research laboratories.

The importance of a thorough grounding in the fundamental subjects of Physics, Mathematics, and Chemistry, cannot be over-emphasized, so these subjects form the major part of the course. The engineer's point of view is secured from the classes of the Faculty of Applied Science, while the breadth of view, necessary for a research worker, is gained from the advanced theoretical classes in the major subjects of the course. Students contemplating taking this course are urged to acquire a reading knowledge of French and German as early in the course as possible.

First Year.

See Page 31

Second Year.

The Second year of any Course, See Page 31.

Third Year.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics VIII.	3a	0	48
Mathematics IX.	3b	0	48
Physics V.	1	3	52
Physics VI.	2a	3a	52
Physics VII.	2b	3b	53
Physics VIII.	2b	0	53
Quantitative Analysis I.	1	3	58
Electrical Engineering II.	2	2	88
German	3	0	45

Fourth Year.

Mathematics X.	3a	0	49
Mathematics XI.	3b	0	49
Physics IX.	3a	0	53
Physics X.	2b	0	53
Physics XI.	2b	0	53
Physics XII.	2a	0	54
Physics XIII.	0	9	54
Electrical Engineering VIII	1	3	88
Electrical Engineering XII	2	3b	89
German or French	3	0	45-46
Economics I.	2	0	46

GRADUATE YEAR IN COMMERCE.

The demand for engineers with business training has led to the establishment of a year's work in Commerce for graduates in Engineering of Queen's and other Universities.

The purpose of this course is to aid in preparing men who already have the technical equipment for work in the administrative or financial branches of industry.

A certificate will be awarded to students successfully completing the course.

Students who have not had an Elementary course in Economics should read in preparationl C.ay, *Economics for the General Reader* or McGibbon *Elementary Economics for the Canadian Reader.* There will be required four and a half courses in such subjects as Accounting Commercial Law, Business Finance, Marketing, Business Policy, Industrial Management and Statistics, and a thesis involving independent investigation of a business problem.

For more detailed prescription see Announcement of Courses in Commerce and Administration.

COURSE FOR B.A. LEADING TO THE DEGREES OF B.A. AND B.Sc. IN SIX YEARS.

Students taking these courses are required to have Arts Matriculation and to register the first two years in Arts alone and pay the class and registration fees in Arts, to register the second two years in both Arts and Science, to pay both registration fees, with examination fees as required, and the Science class fees and to register the last two years in Science only, paying the registration and class fees. Arts classes are subject to the regulations in the Arts Calendar, and Science classes to the regulation in the Science Calendar.

The courses for B.A. and B.Sc. must be taken as laid down in the following scheme. The regulations regarding back classes on page 23 will be applied on these courses.

First Year.

1. English 1.
2. French 1 or German 1.
3. Mathematics 1.
4. Mathematics IV. (Science).
5. Astronomy I. (Science).
6. Physics 1.
7. General Chemistry 1.

Second Year.

1. English 2.
2. French 2 or German 2; or Latin, Greek, or Spanish.
3. Philosophy 1 or 2.
4. 5. Two of History 1, 2, 3, Economics 2.

Third Year.

1. Course from Group I.
2. Course in a subject previously taken but not covered by the later courses in science.
3. Mathematics I., II., and III.
4. Surveying I.
5. Drawing I.
6. Projections I.

Fourth, Fifth, and Sixth Years.

The fourth, fifth, and sixth years are the same as the second, third, and fourth years of the B.Sc. Courses.

If a student on one of these courses wishes to specialize in one or more of the Arts subjects, he may do so in the honour classes.

Attention is called to the fact that by proper selection of classes an entire Arts course leading to the degree M.A. and a B.Sc. course in the Faculty of Applied Science, can be completed in seven years.

SUBJECTS OF STUDY

ENGLISH

LECTURER—WILLIAM A. ALEXANDER, B.A.

FIRST YEAR ENGLISH.

The writing of fortnightly compositions and the study of the following prescribed texts.

J .R. Slater: *Freshman Rhetoric* (New York: D.C., Heath and Company.)

W. L. Macdonald: *English Prose Selections.* (Toronto: The Macmillan Company).

W. M. Thackeray: *Henry Esmond.* (New York and Toronto: Thomas Nelson and Sons.)

Representative Poetry, second and enlarged edition, (University of Toronto Press.)

GERMAN.

PROFESSOR—John Macgillivray, B.A., Ph.D.

LECTURER—

GERMAN A.—PREPARATORY COURSE.

For students in Courses B. and H. third year and fourth year students in Course C.

This course is intended to meet the needs of students who enter the University with little or no knowledge of German. It is taken by students who need it to complete their Matriculation, or who desire to pursue a course in which German text-books or works of reference are prescribed or recommended. The requirements correspond generally to those for Junior Matriculation The course will count towards a degree.

The work comprises drill on pronunciation, a study of the elements of grammar, the reading of easy literature, dictation, oral and written composition.

Text-books: Schrag and Alexis, *First Course in German.*
Baumbach—*Märchen und Gedichte, short selections.* (Ginn).
Collmann, *Easy German Poetry, Selected Poems.* (Ginn).
Schiller, *Das Lied von der Glocke.* (Heath).

Lectures—Tuesday and Wednesday at 4, *Thursday and Saturday* at 8, or at a time to be selected.

GERMAN 3a.—SCIENTIFIC GERMAN.

For fourth year students in Courses B. and H.

This course is designed for students, who are doing advanced work in chemistry, physics, geology, mineralogy, biology and anatomy. The reading will be selected to suit members of the class. Prerequisite: German A, or Matriculation in German.

Text-books: One of:
Helmholtz, *Populäre Vorträge* (Heath).
Du Bois-Reymond, *Wissenschaftliche Vorträge* (Ginn.)
Book to be specially selected.

Lectures—Monday, Wednesday, Friday at 9, or a time to be arranged.

FRENCH.

French A.

Instructor—Jeanne C. McConnell, Brevet Supérior, C.A.P.
T. C. Shore, B.A.

The work of this class prepares the student for French I, and is intended for those who have not Pass Matriculation or its equivalent.

Fraser and Squair: *High School French Grammar.*

Lavisse: *Histoire de France, Cours èlèmentaire* (Heath).

Lectures—Monday, Wednesday and Friday at 2 p.m.

French I

For prescription, hours and instructors, see the Arts Calendar.

SPANISH.

Professor—J. H. Brovedani, Docteur ès Lettres.

VOLUNTARY CLASSES.

ELEMENTARY SPANISH.

This Class meets on Tuesday and Saturday at 9 a.m.

ADVANCED SPANISH.

This Class meets on Monday and Friday at 9 a.m.

N.B.—Students who choose Spanish as a subject for the combined course leading to the degree of B.A. and B.Sc. must take it as prescribed in the Calendar of the Faculty of Arts.

ECONOMICS.

Assistant Professor of Commerce.—C. E. Walker, B.Sc. Acc., C.A.

Economics I.

Required of Fourth Year Students in all courses.

A study of the economic and business problems of the engineer with regard to the organization, financing and management of engineering enterprises and the preparation of accounting and cost records. The course will also include a discussion of law as applied to the business problems dealt with.

Assigned Readings.

Lectures—Monday and Wednesday at 9.

Professor Walker.

MATHEMATICS.

PROFESSOR—J. Matheson, M.A.

PROFESSOR—C. F. Gummer, M.A., Ph.D.

ASSOCIATE PROFESSOR—N. Miller, M.A., Ph.D.

ASSISTANT PROFESSOR—K. P. Johnston, B.A., B.Sc.

ASSISTANT—H. J. Hartman, B.Sc.

1. Mathematics I., II., III., IV. and Astronomy I. are required of all first year students. In addition to the six hours a week allotted to these courses, two hours a week will be spent in working problems under the supervision of members of the Department. These hours are Monday, and Saturday, 10-11.

2. Mathematics V, is required in the second year in all courses.

3. Astronomy II is required in the second year in courses E, F, G and H.

4. Mathematics VI, is required in the third year in courses F. and G; and Mathematics VII. in the third year in Course G.

5. Mathematics VIII., IX. are required in the third year in Course H, and Mathematics X., XI. in the fourth year in Course H.

MATHEMATICS I

TRIGONOMETRY, to cover spherical trigonometry and a review of the more important parts of plane trigonometry.

Tuesday and Thursday, 9-10, 1st term, and *Tuesday,* 9-10, 2nd term.
Professors Gummer and Johnston and Mr. Hartman.

MATHEMATICS II

ALGEBRA, to cover undetermined coefficients, convergence of series, summation of series, continued fractions, exponentials, annuities, solution of numerical equations, and determinants, with a review of the more important parts of Algebra as far as the binomial theorem.

Tuesday and Thursday, 11-12, first term, and *Thursday,* 9-10, 2nd term.
Professor Gummer and Professor Miller.

MATHEMATICS III

ANALYTIC GEOMETRY and introduction to Differential Calculus. A review of the geometry of the straight line and circle, and a study of the conics and other plane curves of importance in engineering. Differentiation of simple functions, with elementary applications.

Tuesday and Thursday, 11-12, second term.
Professor Gummer and Mr. Hartman.

MATHEMATICS IV

SYNTHETIC SOLID GEOMETRY, covering the properties of the principal solid figures, methods and formulae for areas and volumes, etc.

Wednesday and Friday, 10-11, first term.

Professors Gummer and Johnston.

MATHEMATICS V

DIFFERENTIAL AND INTEGRAL CALCULUS, with a continuation of the Analytic Geometry of two and three dimensions, and applications of the calculus to curves and curve tracing, tangents and normals, surfaces of revolution, measurement of lengths, areas, and volumes; pressure, mass centre, moment of inertia, mechanical quadrature, elementary differential equations and applications.

Monday, Wednesday and Friday, 11-12.

Professor Miller.

MATHEMATICS VI

A continuation of Mathematics V. to cover such topics as partial differentation, expansions, double and triple intergration, and differential equations; and a continuation of Analytic Solid Geometry.

Monday and Friday, 11-12, first term, Courses F. G.

Professor Gummer.

MATHEMATICS VII.

A continuation of Mathematics VI, to include the study of hyperbolic functions, the use of the complex variable, and a more detailed study of differential equations and other selected topics.

Wednesday and Friday, 10-11, Course G, second term.

Professor Gummer.

MATHEMATICS VIII.

A course in Determinants and Theory of Equations.

Monday, Wednesday and Friday, 8-9, first term, Course H.

Professor Johnston

MATHEMATICS IX.

A course in Calculus to follow Mathematics V. This course will emphasize the theoretical side of the subject, and prepare for advanced study.

Monday, Wednesday and Friday, 11-12, second term, Course H.

Professor Matheson

MATHEMATICS X.

A course in Analytic Solid Geometry involving a study of various solid figures and of the general properties of surfaces. Introduction to Differential Geometry.

Tuesday, Thursday and Saturday, 8-9, first term, Course H.

Professor Gummer

MATHEMATICS XI.

A course in differential equations to include the more important methods of solution for ordinary and partial differential equations.

Tuesday, Thursday and Saturday, 8-9, second term.

Professor Miller

ASTRONOMY I

ASTRONOMY, including the fundamental principles of the subject, such as the systems of co-ordinates, the shape and motions of the earth, the motions of the moon, planetary motion, time.

Wednesday and Friday, 10-11, second term.

Professor Johnston.

ASTRONOMY II.

Applications of special Trigonometry to Geodosy and Astronomy. The method of least squares.

Tuesday, 10-11. Professor Johnston

PHYSICS.

PROFESSOR—A. L. Clark, B.Sc., Ph.D., F.R.S.C.

RESEARCH PROFESSOR—J. A. Gray, B.S., D.Sc., O.B.E., F.R.S,C,

PROFESSOR—W. C. Baker, M.A.

PROFESSOR—J .K. Robertson, M.A., F.R.S.C.

ASSOCIATE PROFESSOR—E. Flammer, B.Sc., Ph.D.

LECTURER—W. V. Ball, B.A. Sc.

DEMONSTRATORS—J. T. Thwaites, B.Sc., W. C. Gardiner, B.A.

The work in Physics is carried on in lecture and laboratory courses, which run parallel to each other. In the lecture room the fundamental principles are developed and applied, experimental demonstrations given and many problems solved. In all classes in Physics weekly exercises are required of students. In the laboratory a large number of experiments are performed. These are designed to train the student in manipulation of apparatus and instruments of precision, to teach him to make accurate measurements and to give practice in properly recording, interpreting and reducing experimental data.

In all the courses in Physics, the work in the laboratories will be counted as a certain percentage of the whole work of the session. In estimating the standing in the laboratory work, both the quantity and quality of the work done will be considered.

Physics I. and II., together forming a complete introductory course, are taken by all first year students. Previous knowledge, though valuable, is not required. The laboratory work of this year is arranged to supplement the lectures in both Physics I. and II., and credit for this work is given on the written papers in both subjects. Students in both classes have opportunity for assistance by Douglas Tutors. (See page 24).

PHYSICS I.

Required of all first year students.

The subjects dealt with include the elementary treatment of uniformly accelerated motion, Newton's Laws and their application as the basis of Mechanics, Vector addition applied to simple cases of forces, velocities, momenta, etc., Work, Power, Moments, Simple cases of Centre of Mass and of Equilibrium, the application of mechanical ideas to the elementary statics of liquids and gases.

Lectures—Monday and Friday at 11 a.m.

Professor W. C. Baker.

PHYSICS II.

Required of all first year students.

A course of lectures of two hours per week on Magnetism, Electricity, Wave Motion, Sound, Light and Heat. These topics are discussed mathematically and illustrated by experiments.

Lecture—Wednesday, at 11 a.m. *Saturday,* at 9 a.m.

Laboratory—Sect. 3. *Monday,* 1-3 *Sect.* I. *Monday,* 3-5.
Sect. 4. *Thursday,* 1-3, *Sect.* 2. *Thursday,* 3-5.

Professor Clark and Mr. Ball.

PHYSICS III.

This class is required of all students in the second year.

This course of lectures is a continuation of Physics I. Mathematics V is taken at the same time as this class, consequently during the latter part of the year the Calculus is used freely. A general review of the important fundamental principles of Physics occupies the first few weeks. These are then applied to problems dealing with Motion in a Circle, Simple Harmonic Motion, Composition of Simple Harmonic Motions with applications, Moments of Inertia, Rotation, Friction of Belts, Pivots and Bearings, Elasticity in Stretching, Bending and Twisting, Energy and its Transformations.

The laboratory work, which runs parallel with the lectures, is a continuation of the work of the first year.

Lectures—Monday and Friday, 9-10.

Professor Clark.

Laboratory—Courses, A, B, C, D,—Sect. I—*Monday,* 1-3.
" E, F, G, Sect II—*Friday,* 1-3.

Mr. Ball and J. Thwaites

PHYSICS IV. (a)

This class, which is required of students in the second year in Courses A, B, C, D, consists of (a) one lecture per week during the first term, (b) two hours laboratory per week, during the first term.

In the lectures, which deal quantitatively with direct currents, there is a discussion of such topics as Ohm's Law, Shunts, Electrical Energy, Power, Electrolysis, the Voltaic Cell, Electromagnetism, Electromagnetic Induction, and the basic principles of electrical instruments.

The laboratory course includes a series of experiments designed to illustrate the lectures and to train the student in the taking of standard electrical measurements. Instruction in the laboratory may occasionally be supplemented by short explanatory talks.

Lectures—Tuesday, 11-12, first term. Professor Robertson.
Laboratory—Tuesday, 3-5, first term. Professor Clark.

PHYSICS IV.

This class which is required of students in the second year in Courses E, F, G, consists of (a) one lecture per week throughout the year, (b) a laboratory course of two hours per week, during the second term.

In the lectures, fundamental electrical ideas are discussed, with special emphasis on quantitative relations. Problems are assigned weekly dealing with basic ideas of Electrostatics, Ohm's Law, Kirchhoff's Laws, Electrical Energy and opposing Electromotive forces, Electromagnetism, Electrodynamics and Electromagnetic Induction.

The laboratory course includes a series of experiments designed to train the student in standard electrical measurements, as well as to illustrate work discussed in lectures.

Lectures—Wednesday, 9-10. Professor Robertson.

Laboratory—Tuesday, 3-5, second term.
Professor Flammer and Mr. Ball.

PHYSICS V.

Required of third year students in Courses G. and H.

The work of this class comprises a course of lectures on the Elementary, Mathematical Theory of Electricity and Magnetism, and a course of laboratory experiments in advanced electrical measurement.

In the lectures are treated such topics as the more important laws and theories in Electrostatics, the laws of the Magnetic Field, Electrodynamics and Electro-magnetic Induction. At each lecture problems are assigned for solution and these are later discussed in class.

In the laboratory the students make detailed study of several groups of experiments. These comprise careful study of galvanometers using both steady and transient currents, measurements of capacities, permeability, insulation resistance, and self and mutual induction, the use of the potentiometer in measurement of electro-motive force of cells, calibration of voltmeters and ammeters, and study of electrical waves and discharge phenomena.

Lecture—Wednesday, 10-11, first term. Professor Flammer.
Monday, 10-11, second term. Professor Flammer.
Laboratory—Wednesday, 1-4.

PHYSICS VI.

Elementary Theoretical Mechanics.

Required of students in third year of Course H.

This course consists of a series of lectures in which the elements of Statics and Dynamics of a Particle are discussed.

Tuesday and Thursday, 10-11, first term.

Laboratory—Tuesday 2-5, first term. Professor Flammer.

PHYSICS VII.

Thermodynamics.

Required of students in third year of Course H.

A course in which the fundamental laws of Thermodynamics, and their application to the Thermodynamical scale of Temperature, to the treatment of saturated Vapours, and to Reversible Processes in general, are discussed.

Tuesday and Thursday, 10-11, second term.

Laboratory—Tuesday 2-5, second term. Professor Clark.

PHYSICS VIII.

Electricity.

Required of students in third year of Course H.

The general aim of this course is to acquaint the student with the modern developments in such branches of Physics as Radiation, X-rays, Conduction of Electricity through Gases, Radioactivity, etc.

Text Book—Ions, Electrons and Ionizing Radiations, by J. A. Crowther.

Wednesday and Friday, 10-11, second term, Professor Gray.

PHYSICS IX

Mechanics of Rigid and Elastic Bodies.

Required of students in fourth year of Course H.

This course includes a discussion of such topics as the Motion of a Rigid Body, Ellipsoids of Inertia, Motion with fixed Axis and Fixed Point. Euler's Equations, and applications to motion of the symmetrical top; Stress and Strain relations in Elastic Bodies, Elastic Constants.

Monday, Wednesday and Friday, 11-12, first term. Professor Flammer.

PHYSICS X.

Physical Optics.

Required of students in fourth year of Course H.

A course of lectures on the theory and phenomena of Physical Optics, including a discussion of Wave Motion, Diffraction, Interference, Spectroscopes, Polarization and Double Refraction.

Tuesday and Thursday, 11-12, second term. Professor Robertson.

PHYSICS XI.

Electricity.

Required of students in fourth year of Course H.

An advanced course on Electrodynamics and the Conduction of Electricity through Gases.

Monday and Wednesday, 11-12, second term. Professor Flammer.

PHYSICS XII.

Kinetic Theory of Gases.

Required of fourth year students in Course H.

This course includes the topics of the Maxwellian distribution of velocities, free path phenomena, viscosity, thermal conductivity, diffusion, Van der Waal's equation, and the quantum theory as applied to specific heats and to radiation.

Text Book—Kinetic Theory of Gases—Bloch.

Tuesday and Thursday, 11-12, first term. Professor Gray.

PHYSICS XIII.

Required of fourth year students in Course H.

An advanced laboratory course of experiments in Optics, Electricity and Magnetism and Heat.

Monday, Wednesday, Friday, 1-4. Professors Gray and Robertson.

PHYSICS XIV.

Precision Measurements.

Required of third year students in Course B.

A course of laboratory experiments with occasional lectures on precision experiments, involving use of balance, spectroscope and other precision apparatus and accurate measurement of the fundamental quantities of elementary physics.

Friday, 9-11, first term, Professor Flammer.

PHYSICAL LABORATORIES.

The Physics Department is located in the southern half of Ontario Hall, and contains a large lecture room, with a seating capacity of 125, a small lecture room with seating capacity of 60, a small class room, two large rooms equipped as general elementary laboratories, and one room equipped as an electrical laboratory for advanced work. Besides these rooms are the offices for the staff, research rooms, a large, well-lighted library and reading room, smaller rooms for special purposes, apparatus and store rooms. The equipment for lecture table and laboratory is steadily growing and comprises most of the more important pieces of apparatus for these purposes.

Research in Physics is being carried on by members of the staff and by senior students. It is desired to extend this activity as far as possible. A limited number of workers who desire to use the facilities of the laboratory may be admitted and assisted. Particulars may be obtained from the Professor of Physics.

LIBRARY.

The library contains text-books, works of reference, and journals devoted to Physics and related subjects. These may be freely consulted by the student in the reading room between the hours of 8 a.m. and 5 p.m. Books may in general be taken from the building overnight upon reporting to a member of the staff and making a record in a book provided for that purpose. It is only by special permission, however, that any book may be kept longer than one night at a time.

CHEMISTRY.

PROFESSOR OF CHEMISTRY—Arthur C. Neish, A.M., Ph.D., F.C.I.C.

PROFESSOR—L. F. Goodwin, A.C.G.I., Ph.D., F.I.C,

PROFESSOR—J. A. McRae, M.A., Ph.D., F.I.C.

ASSISTANT PROFESSOR—Grenville B. Frost, B.A., Ph.D.

LECTURERS—A. F. C. Cadenhead, B.A., F.C.I.C.

Roy L. Dorrance, M.A.

MILTON HERSEY FELLOW—W R. Sawyer, B. Sc.

DEMONSTRATOR—H .D. McEwen, B.A.

	First Courses.	Second or Advanced Courses.	Research Training Courses.
General and Inorganic Chemistry.	I	II, III	IV
Qualitative Analysis	I, II	———	——
Organic Chemistry	I	II	IV
Quantitative Analysis	I, II	———	IV
Physical Chemistry	I	II IIIb	IV
Industrial Chemistry	I, II	IIIa	IV
Colloid Chemistry	Ib	———	——
Reports and Essays	——	———	——

GENERAL AND IORGANIC CHEMISTRY.

GENERAL CHEMISTRY I.

For all first year students in Science.

This course presupposes a mastery of the contents of matriculation chemistry.

In addition to studying in detail the history, methods of preparation, properties and industrial applications of the most important non-metals and metals and their compounds, the fundamental theories, laws and principles are emphasized. Simple unknowns are also given.

Texts—*Kendall, Smith's College Chemistry,* (Century Co.)

Laboratory Outlines for College Chemistry, (Century Co.)

Lectures—Monday, Wednesday, Friday at 9, in room 310, Gordon Hall.

Laboratory—Sections 1, 2, 3, *Tuesday,* 1-4, *Section* 4, *Wed.* 1-4, in 305, 308, Gordon Hall.

Professor Neish and Assistants.

INORGANIC CHEMISTRY II—Advanced Inorganic Chemistry.

For students in Course B, third year.

This course will consist of a critical study of General Inorganic Chemistry, especially the general chemistry and analytical behavior of the metals.

Text—Lowry, *Inorganic Chemistry,* (Macmillan & Co.)

Lecture—Monday, 10, in room 201, Gordon Hall. Professor Neish.

GENERAL CHEMISTRY III—Advanced General Chemistry.

For students in Course B, fourth year.

The work of the first term of this course involves the general study of chemical reactions from the standpoint of mechanism and equilibrium. Some consideration is also given to the theories of structure of inorganic compounds. The work of the second term is mainly devoted to the study of the phase rule and its applications.

Text Book (second term).

Findlay—The Phase Rule and its Applications (Longmna's, Green).

Lectures—Tuesday and Thursday, at 10, in room 105, Gordon Hall.

Laboratory—Friday, 1-4, first term, in 210 Gordon Hall. Dr. Frost.

GENERAL AND INORGANIC CHEMISTRY IV—Research Training.

For graduate students and students in Course B, fourth year, electing thesis option in General and Inorganic Chemistry.

Professor Neish, Mr. Cadenhead and Dr. Frost.

QUALITATIVE ANALYSIS.

QUALITATIVE ANALYSIS I.—Qualitative and Quantitative Analysis, short course.

For students in Courses E, F, G, second year.

A *short course* of one lecture and two hours laboratory for a year. The qualitative analysis treats of the commoner elements with unknowns suitable for Civil, Electrical and Mechanical Engineering students. The quantitative work is brief and functions as an interpretation course.

Lecture—Wednesday at 10, in room 310, Gordon Hall.

Laboratory—Thursday, 9-11, in rooms 107-109, Gordon Hall.

Mr. Cadenhead.

QUALITATIVE ANALYSIS II.—Qualitative Analysis, full course.

For students in Courses A, B, C, D, second year.

The lectures deal with the Theory of Analytical Chemistry, and emphasize the development and application of the laws of equilibrium as applied to solutions and reversible reactions. The laboratory work includes the systematic analysis of the usual base and acid radicals.

Texts, Stieglitz, *Qualitative Analysis Vol. I.,* (Century Co.).

A. A. Noyes, *Qualitative Chemical Analysis,* 9th *Edition,* (Macmillan Co.)

Reference Text—Treadwell (Hall) Vol. I., (Wiley & Son.)

Lectures—Tuesday and Thursday, at 11, in room 310, Gordon Hall.

Laboratory—Wednesday and Friday 1-4, 107-109, Gordon Hall.

Mr. Cadenhead.

ORGANIC CHEMISTRY.

ORGANIC CHEMISTRY I.—General Organic Chemistry.

For students in Courses B and Dc., third year.

An elementary course in general organic chemistry. The properties of some of the more important compounds are studied in the laboratory and a number of them prepared.

Text—Perkin and Kipping, *Organic Chemistry,* (W. & R. Chambers)

Fisher, *Laboratory Manual of Organic Chemistry,* (Wiley & Sons.)

Lectures—Wednesday and Friday, at 11 in room 105, Gordon Hall.

Laboratory—B students, *Saturday,* 9-12 in room 213, Gordon Hall.

Dc. students, *Monday,* 9-10, 11-12, first term, and 1-5, in the second term.

Professor McRae

ORGANIC CHEMISTRY II.—Advanced Organic Chemistry.

For students in Course B, fourth year.

Advanced systematic organic chemistry including lectures on special topics, such as alkaloids, stereoisomerism and carbohydrates. The laboratory work consists of the preparation of a number of substances to illustrate the general laboratory methods of Organic Chemistry. Practice in quantitative organic analysis is also given.

Texts—Bernthsen—Sudborough, *Organic Chemistry,* (Blackie & Son.)

Cohen, *Practical Organic Chemistry,* (Macmillan Co.)

Books of Reference—Cohen, *Advanced Organic Chemistry,* (Arnold).

Henrich-Johnston. *Theories of Organic Chemistry,* (Wiley & Sons.)

Lectures—Tuesday and Thursday, at 11, in room 105, Gordon Hall.

Laboratory—Wednesday, 1-4, first term; *Friday,* 1-4, second term; *Saturday,* 9-12, in room 213, Gordon Hall.

Professor McRae.

ORGANIC CHEMISTRY IV.—Research Training.

For graduate students and students in Course B, fourth year, electing thesis option in Organic Chemistry. Professor McRae.

Quantitative Analysis.

Quantitative Analysis I.—Short course.

For students in Courses A, C, D, and H, third year.

This is an elementary course designed to illustrate the fundamental procedures of Quantitative Analysis. Gravimetric determinations are made of sulphur, chlorine, iron and phosphorous. A full treatment of volumetric analysis is given including acidimentry and oxidation-reduction methods. The determinations include iron, chromium and manganese in simple ores, iodimetric copper, the analysis of brass, and other similar determinations.

Text—(For Laboratory work only).

Talbot—*Quantitative Chemical Analysis* (Macmillan.)

For Reference, Fales—*Inorganic Quantitative Analysis,* (Century Co.)

Lectures—Thursday 1-2, in room 105, Gordon Hall.

Laboratory—Thursday, 2-5, for A. C. D. and H.
Friday, 8-10, second term for Dc.

Dr. Frost.

Quantitative Analysis II.—Full course.

For students in Course B, third year.

This course is designed to give intensive training in the principles of Quantitative Analysis to students majoring in Chemistry. Considerable emphasis is placed upon class room and recitation work as well as upon laboratory practice. In the class room, students are given practice in the application of the principles of theoretical chemistry to specific analytical problems, great stress being laid upon the development of ability in the prediction of the probable course of reactions and side reactions, and upon the writing of balanced equations for reactions from minimum data. Members of the class are also given practice in the devising of analytical procedures. In the laboratory typical determinations are made, as much time as possible being devoted to the complete analysis of complex mixtures. Comparison of various methods in use in government and industrial laboratories is made by actual trial of these methods by different members of the class.

Text Book—Fales—*Inorganic Quantitative Analysis* (Century Co.)

Reference—Various standard texts, Journal articles and reports.

Lectures—Monday and Wednesday, at 9, in room 105, Gordon Hall.

Laboratory—Thursday, 2-5, and *Friday,* 1-4; and *Wednesday,* 1-4, first term in 207, 209, Gordon Hall. Dr. Frost.

Quantitative Analysis IV.—Research Training.

For graduate students and students in Course B, fourth year, electing thesis option in Quantitative Analysis.

Dr. Frost.

Physical Chemistry.

Physical Chemistry I.

For students in Courses B, C, D, third year.

The principles of Physical Chemistry, and their application to the study of chemical reactions and equilibria. Special attention is given to problems of industrial importance. The laboratory work is designed to acquaint the student with the most important physical chemical measurements and to train him in habits of accuracy, despatch, and in the planning of methods for research.

Texts—Walker, *Elements of Physical Chemistry,* (Macmillan Co.)
Lincoln, *Physical Chemistry,* (Heath & Co.)
Findlay, *Practical Physical Chemistry,* (Longmans, Green & Co.)

Lectures—Tuesday and Thursday, at 9, in room 105, Gordon Hall.

Laboratory—Tuesday, 1-4, in 115, 116, Gordon Hall.

Professor Goodwin.

Physical Chemistry II.—Electrochemistry.

For students in Courses B and D. fourth year.

The work of this course deals with the conduction of the electric current through solutions, considering such quantities as transport numbers, mobility of ions, specific and equivalent conductivity; the electromotive force of concentration cells, with and without diffusion, developed according to the Nernst Theory; dry cells and storage batteries; some industrial applications. The laboratory work consists in determination of the quantities discussed in the lectures and the production of some compounds such as ammonium-persulphate and white lead, electrolytically.

Texts—Thomson—*Theoretical and Applied Electrochemistry* (Macmillan Company.)
Findlay—*Practical Physical Chemistry,* (Longmans, Green & Co.)

Reference—Blum and Hogaboom—*Principles of Electroplating and Electroforming,* (McGraw-Hill.)
Kolthoff and Furman—*Potentiometric Titrations,* (John Wiley.)
Allmand—*Applied Electrochemistry,* (Arnold.)

Lectures—Monday, at 10, in room 105, and *Saturday* at 8, in room 310, Gordon Hall.

Laboratory—Thursday, 1-4, in 101 Gordon Hall,

Mr. Dorrance.

Physical Chemistry IIIb.—Advanced Physical Chemistry.

For students in Course B, fourth year, second term.

This course is designed to give the student an intimate working knowledge of the fundamental principles of Physical Chemistry, as well as a measure of commanding the use of these principles in the solution of chemical problems. Numerous exercises and computations are assigned, as far as possible of the

type likely to be met in subsequent professional work. In the laboratory, practice is obtained in the employment of the theorems derived in the lectures in the planning of experimental procedures and methods of attack.

Text Books—Noyes & Sherrill—*Chemical Principles,* (Macmillan.)
Sherrill—*Laboratory Experiments on Physico-Chemical Principles,* (Macmillan.)

For Reference—Lewis and Randall—*Thermodynamics and the Free Energy of Chemical Substances,* (McGraw-Hill).

Lectures—Monday and Friday, at 11, second term in 201 Gordon Hall.

Laboratory—Wednesday, 1-4, second term in 116 Gordon Hall.

Dr. Frost.

Physical Chemistry IV—Research Training.

For graduate students and students in Course B, fourth year, electing thesis option in Physical Chemistry.

Professor Goodwin, Mr. Dorrance and Dr. Frost.

Industrial Chemistry.

Industrial Chemistry I.—Short course.

For students in Courses A, E, F, fourth year.

A lecture course developed for students in Mining, Mechanical and Civil Engineering. Topics such as the rusting of iron and its preservation, water for steam raising and domestic use, paints, lubricants, explosives, and cements are discussed, mainly from the engineer's point of view.

Texts—Leighou, *Chemistry of Materials,* (McGraw-Hill Co.)
Bulletins of the U. S. Bureau of Mines.

Lecture—Wednesday, at 10, in 105, Gordon Hall.

Professor Goodwin

Industrial Chemistry II.—Long course.

For students in courses B and D, third year.

In the lectures the following topics, illustrated by specimens, lantern slides and motion pictures and visits to plants, will be discussed: Industrial applications of air and water, natural gases, petroleum products, producer gas, water gas, coal gas, by-product coke, sulphur, sulphuric acid (chamber and contact), sulphites, hydrochloric acid, nitric acid and ammonia, nitrates (natural and synthetic), fertilizers, alkalies, mortars, and cements. In the laboratory typical industrial processes as crystallization, precipitation, filtration, distillation and rectifications, incomplete reactions, gas analysis, industrial flow sheets will be carried out and interpreted.

Texts—Rogers, *Manueal of Industrial Chemistry,* (Van Nostrand).
Atack, *Chemist's Year Book,* (Westman Press).

Lectures—Tuesday and Thursday at 10, room 310, Gordon Hall.

Laboratory—B, *Monday,* 1-4, in 101, Gordon Hall.
Dc., *Saturday,* 9-12, in 112, Gordon Hall.
Dm., *Saturday,* 9-12, first term, and *Wednesday,* 1-4, second term in 112 Gordon Hall.

Professors Neish and Goodwin

Industrial Chemistry IIIa.—Advanced.

For students in Course B, fourth year—first term.

This course deals with the following subjects:—Distillation and dephlegmation, wood distillation, alcohol, acetic acid, acetone. Dissolution, decantation, filtration, centrifugals. Manufacture of organic nitro compounds and explosives, cyanamide, ammonia. Equilibrium and optimum conditions for contact sulphuric acid and synthetic ammonia processes, absorption of gases by liquids and solids, absorption and reaction towers. electric furnace products and synthetic acetone, potash manufacture and recovery, recovery of waste acids, ceramics, films, sulphite, sulphate and mechanical wood pulp, paper.

Texts—Partington, *Sulphuric Acid,* (Balliere, Tindall & Co.)
Assigned Reading.

Lectures—Monday and Friday, at 11, first term in 105 Gordon Hall.

Laboratory—Monday, 1-4, first term in 112 Gordon Hall.

Professor Goodwin

Industrial Chemistry IV.—Research Training.

For graduate students and students in Course B, fourth year, electing thesis option in Industrial Chemistry.

Professors Neish and Goodwin

Colloid Ib—Colloid Chemistry.

For students in Course B, fourth year,

An introductory course of three hours per week for the second term. The lectures will deal with the general properties of colloids, surface phenomena, adsorption, and special stress will be laid upon the practical applications of Colloid Chemistry. The importance of the subject in the fields of both inorganic and organic chemistry will be demonstrated by laboratory experiments. These experiments will consist of the preparation of typical colloids, the various methods of identification, electrical properties "gold number," swelling and hydration of gelatins, etc.

Text,—Hatschek—Introduction to Physics and Chemistry of Colloids, new edition, (Churchill).

Lectures and Laboratory—Monday, 1-4, second term; Rooms 105, 201 Gordon Hall. Mr. Cadenhead.

Reports and Essays.

In the fourth year of Course B. Reports and Essays will play an important part in the training of a Chemist. A graduate in Chemistry should be able to use the library, as it is one of the most important tools of the profession, and to this end he should be able to read Scientific German and French.

The work will consist of written reports on assigned topics, the equivalent of two hours per week throughout the year.

Mr. Cadenhead and Mr. Dorrance.

BACTERIOLOGY.

Professor—Guilford B. Reed, M.A., B.Sc., Ph.D.

BACTERIOLOGY XII.

For third year students in Course B.

This course will include a general survey of the nature and behaviour of micro-organisms followed by an experimental study of characteristic bacteriological reactions concerned in industrial processes as alcoholic fermentation, the production of acetone and higher alcohols, vinegar and other acid fermentations, ripening of foods, food decomposition and presenvation. Finally a rapid survey will be made of sanitation as applied to water supplies water purification and sewage disposal plants. Laboratory work and prescribed reading.

Texts—Thomas,*Bacteriology.*
Allen, *Industrial Firmentations.*

Lecture and Laboratory—Wednesday, 1-4, second term; Bacteriological Laboratory, New Medical Building. Professor Reed.

GEOLOGY.

PROFESSOR—M. B. Baker, B.A., B.Sc., F.G.S.A.

ASSISTANT PROFESSOR—B. Rose, B.Sc., Ph.D., F.G.S.A.

The Geological and Mineralogical Museum, situated on the ground floor of Ontario Hall, is equipped with splendid collections of minerals, ores, rocks and fossils, classified and systematically arranged to illustrate most of the subjects treated of in lectures. This is a section of the work in which the co-operation of the mining public is invited, and all donations to this museum will be kept and credited to the donor.

The various courses in Geology, described in some detail below, are intended to equip the professional geologist, the mining engineer, the civil engineer requiring a knowledge of the relative merits of natural construction material. The classes are open to Arts students as well as to those of the engineering professions. Graduates or others wishing to investigate a special geological problem will have all possible facilities in the way of laboratories and apparatus at their disposal.

GEOLOGY I

For second year students in courses A, B, C, and D.

ELEMENTARY GEOLOGY. Students taking this class must have passed in Chemistry I.

An introductory course in general Geology is given preparatory for those students who proceed to a more advanced course in Geology or Mining, and at the same time a more or less complete, though elementary course for those who do not pursue the subject any farther.

The following subjects will be treated of in the lectures: The Atmosphere; the Hydrosphere; the Lithosphere; the probable nature of the Earth's interior; the general characters and classifications of rocks; volcanic action; earthquakes; upheaval and subsidance; glaciation; the geological effects produced by heat, pressure, water; bosses; dykes; veins; stratification; dip and strike; anticline and syncline; faults; foliation; the nature and uses of fossils; stratigraphical geology, and an outline of the history of the Earth.

During the month of October excursions will be conducted to places of geological interest in the vicinity of Kingston. Students in Geology and Mineralogy are required to take part in these excursions.

Lectures—Tuesday and Thursday, 9-10. Professor M. B. Baker.

Text-book: Norton, *Elements of Geology*, (Ginn & Company.)

GEOLOGY II

For third year students in course C.

STRUCTURAL, DYNAMICAL, AND PHYSIOGRAPHICAL GEOLOGY. Before taking this class students must have passed in Geology I.

The principles of gradation, deformation, faulting, mountain formation, and vulcanism are covered in a more general and a more advanced way than in Geology I. Attention is also given to the origin of the Earth; the metamorphic cycle; types of marine and continental sedimentation; an introduction to paleontology, physiography, map reading and interpretation.

Lectures—Monday, Wednesday and Friday, 9-10. Professor Rose.

Text-book: Chamberlin and Salisbury, *Introductory Geology.*

GEOLOGY III.

For students in Courses A and C. third year.

ELEMENTARY PETROGRAPHY. Students must have passed in Geology I, and must take Mineralogy III.

This course is essentially on igneous geology and petrography, and will consist of lectures on the use of the petrographical miscroscope and accessories in the determination of rock forming minerals, and on the determination of some of the more common igneous rocks by both microscopic and field tests. This will be followed by lectures and discussion on the geological occurrences of igneous rocks, the processes of crystalization from magmas, the forms assumed, the textures, and the metamorphic changes that are produced in the mass itself and on its surroundings. The lectures will be supplemented by laboratory work on hand specimens and rock slices.

Lectures—Tuesday, 10-11; and *Wednesday,* 1-2, second term.
Professor M. B. Baker.

Laboratory—Wednesday, 2-4, second term.
Professor Baker.

Text-book: Pirsson, *Rocks and Rock Minerals,* (John Wiley & Sons.)

GEOLOGY V.

For fourth year students in Courses A. and C.

GEOLOGY OF CANADA. Before taking this class, students must have passed in Geology I.

In this course special attention will be given to Stratigraphical Geology, and the distribution of the various rock formations in Canada. The topography as well as the structural make-up of the Dominion is studied. The climatic and economic differences of the various portions of Canada are explained.

Lecture—Wednesday, 8-9, second term. Professor Baker

GEOLOGY VI

For fourth year students in Course C.

Historical Geology... After a brief study of the various types of sedimentary formations and the principles of paleogeography, the history of the North American continent is taken up with supplementary references to the other continents when desirable. Emphasis is laid on Canadian occurrences. A number of the more important fossils of each period are studied, and their recognition on sight required. Brief consideration is also given to the history of the Science of Geology.

Lectures—Tuesday and Thursday, 9-10. Professor Rose.

Text-book—Pirsson and Schuchert, *Text-book of Geology Part II.* (Historical), (John Wiley & Sons.)

GEOLOGY VII.

For fourth year students in Course C.

Advanced Petrography. A course of lectures will be given on the microscopic characters and classification of igneous rocks, and on their general field characters, origin and classification. The lecture work will be supplemented by assigned special reading and by laboratory work with both hand specimens and microscopic slides. Special attention will also be paid to the metamorphic rocks.

Laboratory—Monday, 2-4. Professor Baker.

GEOLOGY VIII

For fourth year students in Courses A. and C.

Economic Geology. This class treats of the principles of ore deposition. For this purpose type deposits in the largest producing districts throughout the world are studied in some detail. It is, of course, impossible to treat of all products, but the basis of classification and the fundamental principles underlying economic deposits are studied with particular reference to iron, copper, nickel, zinc, lead, silver, gold, aluminium, peat coal, gas, oil, salt, abrasive and refractory materials. A few lectures on building stone as well as on clays and the manufacture of clay products will be given.

Lectures—Monday, 10-11; *Tuesday,* 11-12; *Thursday,* 10-11 (b). Professor Baker.

GEOLOGY IX

For third year students in Course E.

Engineering Geology. This course is intended for students in Civil Engineering, and after a brief introduction to geology, will treat of the occurrence, composition, texture, structure and alterations of rocks, with

special reference to their effects on the workability or removal of the rocks in excavation, and in the selection of raw material in construction work. There will also be lectures on clay-products and the selection of building materials, and an outline of the manufacture of bricks, fire-proof blocks, terra-cotta, roofing-tile, sewer-pipe, and drainage-tile, will be given. Physiography and drainage will also be studied, and a brief discussion of the principles of economic geology.

Lectures—Wednesday and Thursday, 11-12. Professor Baker.

Text-book—Ries & Watson, *Elements of Engineering Geology,* (John Wiley & Sons.)

GEOLOGY X

For students in Course C.

Field and Laboratory Geology. The laboratory exercises in this course are designed to illustrate by means of specimens, models, photographs, maps and sections, the principal original and secondary structures of rock; the origin and mode of occurrence of rocks in the earth's crust, their cycles of alteration and change; their interpretation and representation in geological surveys.

The field work comprises observations upon the weathering of rocks; shore phenomena; glacial phenomena; igneous and sedimentary rocks; faulting; folds; joints; cleavage; schistosity. Practice in methods of surveying and geological mapping and construction of sections; measuring the thickness of strata and determining the relative ages of geological structures, and the preparation of a map to scale.

Two working hours per week will be arranged to suit the class at the beginning of the first term.

Field Work—Monday, 1-4.

Professor Rose.

MINERALOGY.

Professor—E. L. Bruce. B.Sc., B.A., Ph.D., F.R.S.C.

Assistant—A. F. Matheson, B.Sc.

The work in this department is intended for students taking the courses in (1) Mining and Metallurgical Engineering, (2) Chemistry, (3) Mineralogy and Geology, and (4) Chemical and Metallurgical Engineering.

It consists of six sections, viz.: Mineralogy I., II., III., IV., V. and VI.

Students in Course A take section I. in the second year and section III. and IV. in the third year.

Students in Course C take section I. in the second year, sections II., III., and IV. in the third year, sections V. and VI. in the third or fourth year.

Students in Courses B and D, take section I. in the second year.

MINERALOGY I

For Second year students in Courses A, B, C, D.

ELEMENTARY MINERALOGY. The work in this class is intended as a preparation for those entering upon the studies of geology, petrography, mining and metallurgy . The class should be taken in the second session, after the Chemistry and Physics of the first session, as a knowledge of Chemistry and Physics is necessary for a proper comprehension of the subject. The regular work consists of (1) a course of lectures and demonstrations on crystallography at the beginning of the fall term, (2) illustrated lectures on the physical, optical and other properties of minerals, (3) the description of about sixty important minerals, (4) practical work in the determination of these by means of the blowpipe and field tests, (5) excursions during October and November for field work. Students are urged to make use of the museum in the basement, and of the study room provided for them in the Mineralogical department.

Each student is supplied for the session with a locked cabinet containing a collection of minerals for which he is held responsible. The practical work of the class is conducted in the mineralogical and blowpipe laboratory, where cabinets containing specimens of commonly occurring minerals are arranged for use. Students are taught to recognize minerals by simple field tests, such as form, color, streak, hardness, specific gravity, etc. For this work students must provide themselves with pocket-lens, knife, and magnet.

Saturday Excursions.

Lecture—Wednesday, 10.

Blowpipe Class—Monday, 3-5.

Text-books: For Courses A, C, Ford, *Dana's Text-book of Mineralogy* (Wiley and Sons, 1922).

For Courses B and D, Ford, *Dana's Manual of Mineralogy.*

Books of Reference:

Crosby, *Tables for the Determination of Minerals.*
Eakle, *Tables.*

Moses & Parsons, *Mineralogy, Crystallography and Blowpipe Analysis,* 5th Ed.

Brush & Penfield, *Manual of Determinative Mineralogy and Blowpipe Analysis,* 17th Ed., 1912 (Wiley & Sons).

Professor Bruce and Mr. Matheson

MINERALOGY II.

SYSTEMATIC MINERALOGY. For students in Course C. Third year.

The regular work consists of a course of lectures, two hours per week, dealing with the physical and other properties of minerals, illustrated by specimens from the lecture cabinet, microscopic slides, thin sections, models, charts and lantern slides. Essays on prescribed subjects are required.

Lectures—Monday and Friday, 10-11; 2nd term. Professor Bruce.

Text-books—Dana, *Text-book of Mineralogy,* 1922. (Wiley & Sons).

Books of Reference:

Miers, *Mineralogy.*
Tschermak, *Mineralogie.*
Bragg, *X-ray and Crystal Structure.* 4th Ed.

MINERALOGY III

For students in Courses A, and C, Third year, first term.

OPTICAL MINERALOGY. The work of this class is intended for those students only who are taking Course A, Mining Engineering, and Course C, Mineralogy and Geology. It is preparatory to the classes of petrography and determinative mineralogy, which should be taken during the session following. The lectures treat of light and the optical properties of minerals. Reflection, diffusion, refraction, dispersion, polarization, absorption, color, etc., are described and illustrated by the use of the lantern and projection apparatus.

Lectures—Thursday, 10-11, *Friday,* 8-9, first term. Professor Bruce.
Text-book: Dana, *Text-book of Mineralogy,* 1922. (Wiley & Sons).

MINERALOGY IV

For students in Courses A, and C. Third year.

DESCRIPTIVE AND DETERMINATIVE MINERALOGY. The work of this class consists in the exhibition and description of the mineral specimens contained in the several museum collections, special attention being given to ores, gangue-minerals, those having a commercial value and those of importance as rock-forming minerals. By field tests and the use of the blow-pipe, practice is obtained in the determination of minerals. A short course in the microscopic determination of opaque minerals is included. Cabinets furnished with specimens of minerals from various parts of the world are supplied for students' use. The number of specimens is being constantly increased by collection, donation, exchange and purchase, the aim being to make the collection as complete as possible. During the 2nd term each student will be requested to study a special group of minerals and present the results of his study to the class.

Lecture—Friday, 1-2, first term. *Thursday,* 10, second term. *Laboratory, Tuesday,* 1-3

Professor Bruce and Mr. Matheson.

Text-book: Dana, *Text-book of Mineralogy,* 1922. (Wiley & Sons).

MINERALOGY V

For students in Course C, Third year

ADVANCED DESCRIPTIVE AND DETERMINATIVE MINERALOGY. This is a lecture and laboratory class dealing with the rarer mineral species, and with the alteration of minerals. It is intended for students specializing in Mineralogy and Geology. This class will alternate with Mineralogy VI. It will be given 1927-28.

Lecture—Wednesday and *Friday* at 11. Professor Bruce.

MINERALOGY VI

For students in Course C, Fourth year.

MINERAL TECHNOLOGY. A course of lectures, illustrated by specimens and lantern slides, supplemented by demonstrations in the museum showing the occurrence and industrial uses of minerals and mineral products.

The following mineral products will be treated: Abrasives, Refractories, Glazes, Ceramic Ware, Lime, Cement, Plaster, Fertilizers, Pigments, Insulators. Gems, Building Stones, etc.

This class will be given in alternate years with Mineralogy V. It will not be given during the session 1927-28.

Lecture—Wednesday and *Friday* at 11. Professor Bruce.

Books of Reference:

Publications of the Geological Survey of Canada.
Publications of the Mines Branch, Department of Mines, Canada.
Publications of the United States Geological Survey.

Research and Thesis—Students wishing to undertake the research work and thesis of the fourth year under the Department of Mineralogy should consult with the instructors not later than the beginning of their fourth year with regard to research subjects and hours.

MINING ENGINEERING.

PROFESSOR—S. N. Graham, B.Sc.

MINING I.

For students in Course A, third year.

PROSPECTING. Methods used in prospecting for lode, placer and coal mines. Location, laws, and requirements, of mineral prospects and their examination.

DEVELOPMENT OF PROSPECTS. The early workings of mines, with a consideration of the many factors entering into the proving up of mineral bodies as commercial quantities.

BORING. The use of long distance drills for prospecting, and for reaching fluids. The rotary Diamond drill, and the percussion drills; their fields of operation and relative merits.

EXCAVATION. The tools and machines used in breaking and removing rock. Also hand and power drilling to place explosive. The common mining explosives; their uses and operation.

MINING METHODS. A consideration of the main factors in developing a mine. The sinking of shafts; driving of tunnels, etc. The stoping or winning of minerals from the vein or ore body.

Lectures—Wednesday, 11-12; *Tuesday,* 9-10, second term.

Laboratory—Tuesday, 9-10. first term.

Professor Graham.

Books of Reference:

Hoover, *Principles of Mining.*

Peele, *Mining Engineers' Handbook.*

MINING II.

For students in Course A, fourth year.

PLACER MINING. Consideration of alluvial deposits and their origin: placer mining proper, hydraulic placer, and gold dredging.

SUPPORTS. Various forms of timbering or supporting a mine's passages, and stope excavations. The timbers used. Costs and alternative methods; causes of decay in timbers and their preservation. The use of iron and masonry.

TRANSPORATION. The handling of material underground, by chutes, cars, and hoists; rope and locomotive haulage. Surface transportation by road, rope, and railway. Loading, unloading, and terminal arrangements.

HOISTING. Head frames, ropes, and drums; various systems which balance the load to some extent or give a steady load on the engines.: Hoisting of ore. Safety appliances and signalling.

DRAINAGE. Sources of water, drainage by tunnels; hoisting of water; use of pumps, and principal types for light and heavy work. Bulkheads.

VENTILATING. Natural and artificial conditions which demand ventilation. Methods of ventilating metal and coal mines. Gases of a coal mine. Fans, and distribution of air in coal mines.

LIGHTING. Use and place of candles, lamps, and safety lamps.

ACCIDENTS.. PRINCIPLES OF EMPLOYMENT.

MINE EXAMINATION AND VALUATION.

STUDENTS' PAPERS. These are hour and half hour talks upon observations from experience in the field.

Lectures—Monday, 11-12; *Tuesday,* 1-2; *Thursday,* 10-11, first term and *Tuesday,* 10-11, second term. Professor Graham.

Books of Reference:

Peele, *Mining Engineers' Handbook.*
Hoove, *Principles of Mining.*
Young, *Elements of Mining.*
Finlay, *Cost of Mining.*
Storms, *Timbering and Mining.*
McGarraugh, *Mine Book-keeping.*

Mining III.

For students in Course A, fourth year.

The first term work includes practice and problems in Mine Surveying, also the reduction and plotting of a mine survey

In the second term these hours are given to furnace and metallurgical work and to any subject suitable to the course, as a subject for designing, for example, the designing of mill, smelter, surface plant of a mine.

Monday and Wednesday, 1-4; Professors MacKay and Graham.

Mining IV.

For students in Courses C and Dm. fourth year.

This is a course of lectures briefly discussing the formation of ore-bodies, their development and exploitation, the machinery and equipment required, and the sampling and valuation of mining properties. It is intended to link up the work of the geologist and metallurgist with the mine.

Lectures—Monday 1-2; and *Wednesday* 8-9; first term.
Professor Graham.

Summer Essay.

For students in Course A, fourth year.

In order to encourage close observation, and the faculty of expressing by text and illustration, the student during his summer vacations is expected to gather material for an essay of from two to three thousand words.

The subject title must be given before the end of October. and the essay handed in before the end of the first term. Essays requiring revision must be returned before the spring examinations begin.

All essays must be type-written and suitably bound.

Ore Dressing.

For students in Courses A, C, Dm., third year, Dc., fourth year.

These lectures follow quite closely the subject as taken up in Richards' Text-book of Ore Dressing. They follow the sequence of operations from the arrival of crude ore or mill-rock at the mill until it leaves as a concentrate or bullion. Miscellaneous processes such as magnetic separation, flotation air processes, and coal washing, are discussed separately.

The chief features of this subject are to teach the principles and operations of rock crushing and grinding, screening and sizing of crushed ore, classification of sands and slime by water, as a preparatoin for the separation of minerals by jigs, tables, flotation and other devices of proved efficiency.

Lectures—Thursday, 11-12; *Tuesday,* 11-12, second term.

Professor Graham.

Books of Reference:

Richards and Locke, *Text-book of Ore Dressing.*
Peele, *Mining Engineers' Handbook.*
Wiard, *The Theory and Practice of Ore Dressing.*
Taggart, *Manual of Flotation Processes.*
Truscott, *Ore Dressing.*

Milling.

For students in Course A and Dm. fourth year.

The machinery in the Mill is in most cases of standard sizes and the ores treated are in sufficient quantities to give results which are about the same as commercial practice would give. The uses of the Mill and Laboratories are to furnish training and illustration, to experiment with various processes, and to give help at very reasonable rates to those who are seeking some method of treatment. The ores received are sufficient in quantity and variety to illustrate most of the usual methods of treatment found in actual practice. The work is divided into three main portions.

Laboratory—Friday, 8-4; *Saturday,* 9-12.

Professors MacKay and Graham.

The Mining and Metallurgical Laboratories.

These are equipped for the testing of ores in small lots from various mining districts.

The equipment of the mill as it stands at present consists of the following:—10 in. by 7 in. Blake jaw crusher; 16 in. crushing rolls; 5 stamp battery, 850 lbs., stamps with automatic feeder; 10 in. cone grinder; No. 0 Krupp Ball Mill; impact screen; inlet discharge classifier;

vertical line classifier; U-tube classifier for slimes; perforated board-classifier for slimes; cone classifier for 8-foot Callow tank; pipe classifier; 3 compartment spitzkasten; 3 compartment Hartz jig; miniature Hortz jig; 1 Vezin jig; 4 ft. Frue Vanner; Wilfly table (riffle washer); Plato-O table; 8 foot callow tank; Wetherell magnetic concentrator; Ball-Norton magnetic separator; Kingston magnetic separator, dry or wet; Behrend dry concentrator; Sturtevant exhauster and blower; Heald and Sisco centrifugal pump; Frenier and Sons' spiral sand pump; Cazin water-motor; Northey mine pump; centrifugal machine for slime treatment; Johnston filter press for slime treatment; Ingersoll-Sergeant rock drill; Mac Machine Company's balanced valve rock drill; Rand rock drill; tripods for rock drill; drifting column for rock drill; Jackson's hand power rock drill; barrel chlorination plant; experimental cyanide apparatus with an air agitator and vacuum filter; Case Laboratory flotation machine; Wood flotation machine.

The Mining and Milling Laboratories.

With the exception of the work given in the Mining and Milling Laboratories all the work in the Department of Mining and Metallurgy is given in Nicol Hall. In the basement of the building there are a large number of furnaces and four laboratories. On the first and second floors are the lecture rooms, draughting room and library.

The Metallurgical laboratory is well equipped with furnaces which may be classed as follows:—

One large blast-furnace (40" by 24") with a bag-house (16 bags); one large roasting furnace (10" by 4') with three charging doors; one Monarch oil furnace for obtaining temperature up to 1400°C.; one Hoskins electric resistance furnace for temperatures up to 1700°C.; one vacuum electric furnace; two tubular electrical furnaces; six gas muffle-furnaces and eight gasoline furnaces.

In the rear of the basement there is a sampling room with power and hand grinding machines and apparatus for preparing the necessary samples for the assay laboratories.

The greater part of the eastern half of the basement is devoted to fire assaying. These laboratories are equipped with fluxing and balance tables; basoline crucible furnace; gasoline, gas, and oil muffle furnaces; and accessory apparatus.

A separate balance room is fitted with assay and chemical balances to be used in connection with the fire assaying and the chemical work carried out in the two front rooms. The latter laboratories will accommodate the final year students in Mining and Metallurgy, and be used in conjunction with the Milling and Metallurgical laboratory work.

A small room in front is fitted with electrolytic assaying.

The western half of the basement is devoted to Metallurgical laboratories and is equipped with electric furnaces, blast furnaces, roasting furnaces, etc., and with sufficient power for extended research work.

The Metallurgy lecture room, second research laboratory, cloakrooms, etc., are on the first floor; and the Mining lecture room, draughting room and students' library on the second floor.

METALLURGY.

PROFESSOR—G. J. MacKay, B.Sc.

LECTURER—O. A. Carson, B.Sc., A.M.

METALLURGY I.

For students in Courses E, F, G, third year.

A brief discussion of the physical properties and uses of the common metals. The more important industrial alloys, their composition, properties and uses. Refractory materials. The properties of iron and steel, the effects of impurities and of methods of manufacture and working, and the heat treatment of steel.

Lecture—Tuesday, 10-11. Professor McKay.

METALLURGY II

For students in Courses A, B, Dm., third year and for Courses C, Dc. fourth year.

Heat, calorimetry and pyrometry. Solid, liquid, and gaseous fuels and the special metallurgical uses of each kind. An introduction to general metallurgy—principles, operations and appliances. The metallurgy of iron and steel.

Lectures—Monday, 11-12; *Wednesday,* 10-11. Professor MacKay.

Text-book—Stoughton, *The Metallurgy of Iron and Steel.*

METALLURGY III

For students in Course Dm. third year.

Metallurgical calculations based on the work covered in Metallurgy II.—heat, calorimentry, and pyrometry; heat balance, iron blast furnace charges, etc.

Lecture—Monday, 9-10, second term. Professor MacKay.

METALLURGY IV.

For students in Courses A, Dm. fourth year.

The metallurgy of the more common non-ferrous metals—gold, silver,

copper, lead, and zinc. The extraction of these metals from their ores, the refining of the metals, their uses, and the alloys into which they enter.

A consideration of the ordinary methods of recovering nickel, cobalt, tin, arsenic, antimony, etc., from the ores.

Lectures—Tuesday, 9-10; *Wednesday,* 11-12; *Thursday,* 11-12.
Professor MacKay.

Text-book—Gowland, *Metallurgy of the Non-Ferrous Metals.*

Metallurgy v.

For students in Course Dm. fourth year.

Metallurgical calculations related to the work covered in Metallurgy IV. Discussions of metallurgical subjects by the students and the reading and discussion of students' essays.

Lectures—Tuesday, 11-12, first term; *Tuesday,* 8-9, second term.
Professor MacKay.

Metallurgy vi.

For students in Courses Dm, G. fourth year.

Electro-metallurgy; introductory course in electro-chemistry followed by the consideration of the electrolytic refining of copper, gold and silver and the electrical smelting of aluminum and iron ores, etc.

Lecture—Wednesday, 8-9, second term. Professor MacKay.

Metallurgy vii.

For students in Course Dm. fourth year.

Metallurgical plant design. The calculation of the capacities of units in a plant—agitators, sumps, pipes, launders, pumps, furnaces, converters, etc. Details of equipment. Flow sheets. General layout of plants. Bills of material. Power requirements.

The work will consist largely of individual problems for the library and drafting room.

Laboratory—Tuesday, 1-3. Professor MacKay.

Metallurgy viii.

For students in Course F, fourth year.

Laboratory course dealing with the heat treatment of steel.

Laboratory—Friday, 8-10, first term. Mr. Carson.

Metallography.

For students in Course Dm. fourth year.

Introductory course in metallography, including:

(*a*) Explanation and interpretation of equilibrium diagrams.

(*b*) Constitution and structure of some industrial alloys, with special reference to brasses, bronzes, bearing metals and different grades of steel.

Lecture and laboratory work—Saturday, 9-12. Mr. Carson

Metallurgical Laboratory I. and II.

For students in Course D. fourth year.

Laboratory course dealing with a number of metallurgical operations The following experiments are made by the students attending this course: Determination of calorific power and impurities in coals, desilveri zation of lead by the Parke's process, standardization of pyrometers by various methods, determinations of cooling curves, decomposition of sulphates and reduction of oxides.

Electroplating, operation of the blast-furnace and electric furnace, and laboratory work in metallography.

Laboratory—II. *Wednesday,* 1-4, Dm.

Laboratory—I. *Friday,* 1-4, second term, Dc. Mr. Carson

Summer Essay.

Required of students in Course Dm. fourth year.

In order to encourage close observation, and the faculty of expressing by text and illustration, the student during his summer vacations is expected to gather material for an essay of from two to three thousand words.

The subject title must be given in by October 15th of the final year, and the essay handed in before the end of the first, term of the final year. Essays requiring revision must be returned before the spring examinations begin.

Fire Assaying.

For students in Courses A, Dm., third year and Course C, fourth year.

The Laboratory course in fire assaying consists of:

(*a*) A number of experiments to test the action of the different reagents used and slags made in assaying.

(*b*) The determination of lead by fire assay methods.

(*c*) The determination of gold and silver in silicious, oxidized and sulphide ores and mattes.

(*d*) The assay of gold and silver bullion.

Lecture—Saturday, 8-9, *Laboratory,* 9-12, second term.

Professor MacKay.

CHEMICAL ENGINEERING.

Professor—L. F. Goodwin, A.C.G.I., Ph.D., F.I.C.
Assistant—A. G. Muirhead, B.Sc.

Chemical Engineering I.

For students in Course Dc. third year.

A preparatory course in plant construction; Stoichiometrical calculations, and problems in Applied Physical Chemistry

Lecture and Laboratory—Monday and Thursday at 11, second term.
Professor Goodwin.

Chemical Engineering II.

For students in Course Dc. fourth year.

Industrial Processes.—The subjects dealt with comprise: distillation and dephlegmation, wood distillation, alcohol, acetic acid, acetone. Plant for nitric acid manufacture. Influence of heats of reaction, examples distillation of nitric acid and acetone. Atmospheric nitric acid, synthetic ammonia, sulphuric acid, a study of the equilibria and optimum conditions involvel in their manufacture. Dissolution, decantation, filtration, centrifugals. The moving of gases, liquids and solids. The measurement of gases and their absorption by liquids and solids. Absorption and reaction towers and their design. Filling materials and the considerations governing their action and efficiency. The manufacture of nitro compounds, the concentration of weak acids and the recovery of waste acids.

Pulp, Paper and Synthetic Plastics—Absorption principles and sulphite towers. The manufacture of mechanical and sulphite wood pulp. The Kraft or Sulphate, and the soda process, modern methods of causticising, washing, and of lime, soda and heat recovery. The elements of paper manufacture. The manufacture of gun cotton, cordite, nitro-cellulose powder, celluloid, viscose or artificial silk, and of other synthetic colloids.

A collection of industrial products and apparatus is available for demonstration, and visits are paid to outside chemical works at which attendance is required.

Designing of Chemical Plant. Calculations and exercises in designing chemical apparatus and factories. Furnaces and fuels, evaporators, dryers, waste heat recovery. Considerations underlying the choice of materials of construction, acid proof containers and cements. The design of a nitric acid plant and the evolution of structural details. Manufacturing costs as dependent on cost of plant, raw materials, labour, etc.

Lectures—Wednesday and Friday, 11 a.m.
Laboratory—Wednesday, 1-4.
Professor Goodwin.

Texts.—Partington, *The Alkali Industry.*
Walker, Lewis and McAdams, *Chemical Engineering.*
Assigned Reading from:
Davies, *Handbook of Chemical Engineering.*
Lunge, *Sulphuric Acid and Alkali.*
And Original Publications.

CHEMICAL ENGINEERING III.

Laboratory Work and Drawing.

A detailed study of apparatus and chemical engineering plant, based on the chemical and physical conditions underlying the various processes.

The elaboration in the laboratory of the best working conditions for a given chemical process.

The study of technical methods of analysis, including rapid methods, and those involving the use of special apparatus and conditions.

The designing and drawing of parts of a chemical plant, based on experimental results worked out in the laboratory. Experimental work on semi-plant scale chemical engineering apparatus.

The practical work will be divided between the laboratory and the draughting room as is found necessary.

Lecture—Tuesday, 11 first term, *Thursday,* 10 second term.

Laboratory—Monday 1-5, *Friday* 9-11.

Professor Goodwin and Mr Muirhead.

Texts.—Assigned reading from:

Davies, *Handbook of Chemical Engineering.*

Lunge-Cummings, *Sulphuric Acid and Alkali,*

And published papers and pamphlets.

LABORATORY OF CHEMICAL ENGINEERING.

The laboratory is provided with large size models of a ball mill, of steam-jacketed evaporating pans, both plain and porcelain lined and fitted with stirring gear. with a steam-jacketed rectifying column and still, a steam jacketed double effect vacuum evaporator, pump and condenser, a jacketed vacuum shelf dryer, a high pressure acid proof filter, a Sweetland self-dumping filter press with sludge tank and centrifugal pump, a model stream-line filter, several types of vacuum filters, an ordinary and a high speed centrifuge, a rotating high pressure autoclave, and with other technical apparatus.

There is further installed a large reaction tower of earthenware designed for experimental purposes, connected to a fan, ventilating flues and measuring devices, and provided with a liquor circulating system and motor driven pump, and with selected types of earthenware filling material.

A portable electric motor is available for power purposes, and there are installed balances for the rapid weighing of small and large quantities, together with various types of special analytical apparatus.

Instruction in this laboratory is planned to train the student to handle fairly large quantities of material and to become familiar with standard types of technical chemical apparatus, to work out the experimental methods required for attacking a problem, and to translate the laboratory results obtained into practice.

CIVIL ENGINEERING.

PROFESSOR—A Macphail.
PROFESSOR—W. P. Wilgar.
PROFESSOR—W. L. Malcolm.
ASSOCIATE PROFESSOR—D. S. Ellis.

GENERAL ENGINEERING I.

For students in all Courses second year.

This subject embraces the physical properties of materials used in the different branches of engineering and the principles involved in the theory of beams, columns, and structures.

MATERIALS OF CONSTRUCTION—Resistance and elasticity of materials; stresses in brick, cement, mortar, and concrete; physical properties of the metals and alloys used in engineering, and efforts of impurities in them; testing for tensile, compressive and transverse strength.

GRAPHICAL STATICS. Graphical representation of stress; funicular and force polygons; dead and wind loads; graphical methods of determining centres of gravity, shear and bending moments.

MECHANICS OF MATERIALS.—Resistance and elasticity of materials; stress and strain diagrams; bending and shearing forces; compound stress; deflection of beams; columns and struts; riveted joints; centres of gravity and moments of inertia.

Lectures—Monday and Friday 10-11. Professor Macphail.

Text-books—Wolfe, *Graphical Analysis*
Merriman, *Mechanics of Materials.*

Books of Reference:

Merriman, *Strength of Materials.*
Thurston, *Materials of Construction.*
Merriman and Jacoby, *Roofs and Bridges, Part II.*
Slocum & Hancock, *Strength of Materials.*

GENERAL ENGINEERING II

For students in Course E, third year.

GRAPHICAL STATICS. Graphical determination of stresses in roof trusses, bridges, cranes, earth-works, retaining walls, dams, arches, arched ribs cantilever and suspension bridges.

MECHANICS OF MATERIALS. Analysis of restrained and continuous beams and columns; torsion of shafts; combined stress; flexure of beams and theorem of three moments; plate and lattice girders and columns; resilience and fatigue of materials; initial and temperature stresses; earthworks, retaining walls and dams; arches and arched ribs; suspension bridges.:

THEORY OF STRUCTURES. Girders, roofs and bridges; selection of types with reference to span, loading, head-room, cost, and other considerations; relative advantages of riveted and pin connections; wind bracing and stiffening trusses; trestles and towers.

Lecture—Monday, 11-12; *Tuesday,* 11-12. Professor Macphail.

Text-books—Malcolm, *Graphic Statics.*
Merriman, *Mechanics of Materials.*

Books of Reference—

Slocum & Hancock, *Strength of Materials.*
Bovey, *Theory of Structure.*
Merriman and Jacoby, *Roofs and Bridges, Parts, I., II., III.*

GENERAL ENGINEERING III.

For students in Courses, A, D, E, F, G, third year.

This course consists of practical work in the mechical, hydraulic and hydraulic and testing laboratories. Its object is to give the student a knowledge of the practical application of the fundamental principles of engineering in general.

Routine tests of cement, lime, mortar, brick, stone, timber, iron, steel, etc. Specific gravity, fineness, tensile and compressive strength of cement, etc.

Hydraulic Experiments.

Measurement of mechanical power by means of indicators, dynamometers, etc. Simple experiments in thermodynamic laboratory.

Laboratory—Monday, 1-3, for A, D, and G, students.
Monday, 3-5, for E, and F, students.
Professors Macphail, Arkley, Ellis and Rutledge.

GENERAL ENGINEERING IV.

For students in Course E, fourth year.

Independent work in the testing laboratories.

Laboratory—Saturday, 10-12, first term. Professor Macphail

GENERAL ENGINEERING V.

For students in Courses A, D, F, G, third year.

A combined course of lectures, and designing covering the same subjects as in General Engineering II.

Lecture—Wednesday, 9-10; *draughting, Friday,* 2-4.
Professor Macphail.

Text-books—Same as for General Engineering II.

GENERAL ENGINEERING VI.

For students in Course E, third year.

GRAPHICAL REPRESENTATION. Representation of engineering formulae and data. Progress and cost diagrams, interpretation of diagrams, solution of problems by means of diagrams.

GRAPHICAL STATICS. Continuation of work in General Engineering II., with relation to roofs, bridges, arches and other structures. Practical work in draughting room.

Lecture—Wednesday, 10-11.

Draughting—Friday, 1-4. Professor Malcolm.

Text-book—Wolfe, *Graphical Analysis.*

STRUCTURAL ENGINEERING I.

For students in Course E, third year.

The work of this class comprises lectures and draughting room work in design of buildings.

In the draughting room students are required to design and detail roofs and other parts of buildings, treating wood, and steel as their materials of construction.

Lecture—Friday, 11-12.

Draughting—Saturday, 9-12. Professor Wilgar.

Text-books—*Steel Handbook.*

Books of Reference—*Ketchum Structural Engineers Hand Book.*
Hool and Kinne, *Structural Members and connections, and steel and timber structures.*

STRUCTURAL ENGINEERING II.

For students in Course E, fourth year.

Design of reinforced concrete structures. Foundations of bridges, buildings, and other structures, cofferdams, caissons, substructure types and designs.

Lectures—Tuesday, 8-9, *Thursday,* 11-12, first term; *Tuesday* 10-11, *Thursday,* 11-12, second term

Draughting—Monday, 1-3, *Friday,* 1-4. Professor Wilgar.

Text-books—Hool and Kinne, *Foundations, Abutments and Footings.*
Hool and Johnson, *Concrete Engineers Handbook.*

Books of Reference—

Jacoby and Davis, *Foundations of Bridges and Buildings.*
Patton, *Foundations.*
Fowler, *Subaqueous Foundations.*
Hool and Kinne, *Reinforced Concrete and Masonry Structures.*

STRUCTURAL ENGINEERING III.

For students in Course Dc, fourth year.

DESIGN OF STRUCTURES. Simple roofs in wood and steel. Foundations. Reinforced concrete. Design of structures essential for Chemical Engineers.

Lecture—Saturday, 9-10.

Draughting—Tuesday, 1-4. Professor Macphail.

Books of Reference—Jacoby, *Framed Structures.*
Ketchum, *Structural Engineer's Handbook.*
Hool & Johnson, *Concrete Engineer's Handbook.*

STRUCTURAL ENGINEERING IV.

For students in Course E, fourth year.

DESIGN OF STRUCTURES. Lectures comprise the design of details in steel bridge trusses and other structures.

Projects will be given to the class in Bridge Design according to Standard Specifications, usually consisting of riveted truss, pin-connected truss, etc. Complete stress sheets, working drawings, estimates, etc., being required.

Lecture—Tuesday, 9-10.

Draughting—Wednesday, 1-4; *Friday,* 10-12.

Professor Macphail.

Text-books—Ketchum, *Structural Engineer's Handbook; Steel Handbook.*

Books of Reference—Merriman and Jacoby, *Roofs and Bridges, Pts. I.-IV.*
Waddell, *Bridge Engineering.*

HYDRAULIC ENGINEERING I.

For students in courses E. F. G. third year, and A, D, fourth year.

Application of hydrostatic pressure in the case of dams, gates and pipes. Flow of water and measurement of its volume by various orifices and weirs. Flow in open channels, ditches, flumes, etc., and the use and application of these conductors of waters. Flow through tubes and pipes. Use of pipes as conductors of supply for domestic and power purposes. Dynamic and static pressure as applied to motors for power purposes. The study of various water wheels, turbines, etc.

Experiments to cover above principles,

Lectures—Tuesday, 8-10, E, F, G. *Monday,* 8-9, *Thursday,* 8-9, A. D.

Text-book—King & Wisler, *"Hydraulics."* Professor Ellis.

HYDRAULIC ENGINEERING II

For students in E, F, and G, fourth year.

Comprises the study of hydrology; design and construction of dams and appendages; measurement, development and transmission of water-power; design of hydraulic power plants.

Problems and laboratory work in relation to these subjects.

Lecture—Friday, 8-10, E,G, *Monday,* 11-12 and *Thursday,* 9-10.

Professor Ellis

HYDRAULIC ENGINEERING III

For students in Courses E and G, fourth year.

Work in Hydraulic Laboratory or selected experiments dealing with, hydrostatic pressure, orifice, and weir flow, flow through pipes and open channels, loss in valves and pipe fittings, efficiency tests on centrifugal pumps, and reaction and impulse turbine. Investigation of flow in draft tube, Special studies as opportunity offers.

Laboratory—Saturday, 10-12, G, first term, E, second term.

Professor Ellis

RAILWAY ENGINEERING I

For students in Course E, third year.

The work of this class comprises the study of economics of railway location; estimation of traffic; effects of distance, rise and fall, curvature, on costs of operation.

The paper location of a railway; economic selection of alternative routes; turnouts; crossings; Mass diagram; overhaul; estimation of costs of construction.

Lectures—Monday, 9-10, first term, *Thursday,* 9-10.

Field Work and Draughting—Wednesday, 1-4.

Text-book—Webb, *Railroad Construction.*

Book of Reference—Wellington, *The Economic Theory of Railway Location.*

Professor Wilgar.

RAILWAY ENGINEERING II

For students in Course E, fourth year.

A course in Railway Construction. The preparation of a contractors tender for grading, track laying, ballasting, etc. Railway organization for operation, maintenance of way and structure, yards, terminals and signalling.

Lecture—Tuesday, 11-12.

Draughting—Tuesday, 1-4.

Books of Reference—Gillette, *Cost Data;* Webb, *Railroad Construction;*
Orrock: *Railroad Structure and Estimates.*
Tratman: *Railway Track and Trackwork.*

Professor Wilgar.

ENGINEERING ECONOMICS.

For students in Course E, fourth year.

Valuation of public utilities, depreciation, amortization, government control of public utilities as exemplied by the Railway Act. Specifications and engineering contracts. Economic selection of structures and plant.

Students will undertake periodical lectures on any chosen subject in this course.

Lecture—Thursday, 10-11. Professor Wilgar.

Books of Reference—Mead, *Contracts, Specifications and Engineering Relations;* Gillette and Dana, *Construction Cost Keeping and Management.*

MUNICIPAL ENGINEERING I.

For students in Course E, third year.

Discussion of Municipal Problems.

Monday, 9-10 and *Wednesday,* 9-10; second term.

Professor Malcolm.

MUNICIPAL ENGINEERING II.

For students in Course E, fourth year.

Water Supply. Municipal water supply. Rainfall. Source of supply. Quantity, quality and purification of water. Distribution, designing and details of construction. Domestic systems.

Lecture—Monday, 10-11 and *Wednesday,* 11-12; 2nd term.

Professor Malcolm.

Text-book—Turneaure and Russell, *Public Water Supplies.*

MUNICIPAL ENGINEERING III.

For students in Course E, fourth year.

The Collection and Disposal of Sewage and Refuse.

Sewage. The various systems for the collection and removal of sewage. Design. Consideration of rainfall, run off, and water consumption. Proportioning of size. Grades and flow in sewers. Methods of construction and materials used. Plumbing. Maintenance of sewer systems, including ventilation, flushing, and inspection.

Sewage Disposal. Methods employed, Design, construction, and maintenance of the various systems.

REFUSE DISPOSAL. Kinds of refuse. Methods of collection and disposal and economic value of same. Incinerators.

Lecture—Monday, 11-12. Professor Malcolm.

Laboratory—Thursday 1-4, second term.

Text Book—Metcalfe and Eddy—Sewerage and Sewage Treatment.

Book of Reference—Metcalfe & Eddy, *American Sewerage Practise Vols. I. II and III.*
Babbit, *Sewerage and Sewage Treatment.*

NOTE

Work in Municipal Engineering II. and III and Highway Engineering has been arranged for one period of three hours per week, *Thursday,* 1-4. Projects in water works, sewer designs, etc., are set and completed during these hours. As far as possible each student will be given separate problems. A time limit is set on each problem.

HIGHWAY ENGINEERING.

For students in Fourth Year, Course E.

Country and city roads and pavements. Lay out, grades, and roadbeds. Various kinds of pavements and methods of construction. Cost and durability. Gutters, curbs, and gullies. Various kinds of walks, methods of construction, materials used. Method of dust prevention. Construction with street railway track. Methods of assessment. Conduit systems, and lighting of streets.

Projects in highway work are set under actual conditions for survey design and estimate.

ELECTRIC RAILWAYS. Trackwork, including construction in paving, power supply, cars and car types, factors entering into economics of construction and operation.

Lecture—Monday, 10-11; *Wednesday,* 11-12, first term.
Professor Malcolm.

Laboratory—Thursday 1-4, first term.

Text-book—Agg, *Construction of Roads and Pavements.*

Books of Reference—*American Highway Engineers Handbook.*
Blanchard and Drowne, *Highway Construction.*

SURVEYING.

All branches of Surveying receive full consideration. During the outdoor instruction students are given every opportunity to become familiar with the instruments. Notes of all field work are plotted in the draughting-room, and the rules and regulations for field work and instruments-room must be strictly adhered to. Students must be engaged in the work of a class in the hours set apart for it, otherwise their attendance will not be counted. Attendance and character of work done will be considered in the class standing.

SURVEYING I.

Required of all first year students.

The description, use, adjustment and care of chains, tapes, compasses, levels, transits and minor surveying equipment, Methods employed in elementary surveying.

The practical work in the field and draughting rooms is an important part of this course.

Lecture—Field Work, Friday, 2-4. Professor Ellis.

SURVEYING II.

For students in Courses E, F, G, second year.

It continues the work of Surveying I., and includes Railroad Surveying—Curves, curve problems in location, levelling, profiles, elements of switchwork: Topographic Surveying—with stadia, plane table, hand level, and transit and level; Reconnaissance and simple triangulation; Hydrographic Surveying—Methods, sextant, river surveying, stream flow; Laying out of buildings and engineering construction. Underground Surveying. Observations.

Lecture—Thursday, 11-12.

Field Work and Draughting—Wednesday, 1-4 (a).
Monday, 1-4 (b). Professor Malcolm.

SURVEYING III.

For students in Courses A, B, C, and D, second year.

It will continue the work of surveying I. Brief courses in the following will be covered: (1) Railroad Surveying, simple curves, simple turnouts, frogs and switches. Profile and vertical curves. (2) Topographic Surveying—Stadia, plane table, hand-level. (3) Hydrographic Surveying—Sextant, soundings, stream flow. (4) Reconnaisance—Simple Triangulation. (5) Earthwork. (6) Layout of engineering structures. (7) Underground Surveying. (8) Observations.

Lectures—Thursday, 10-11.

Draughting—Thursday 1-4. Professor Malcolm

SURVEYING IV.

For students in Course E, third year.

Topographic Surveying, Stream Measurement, Hydrographic Surveying, Mine Surveying, Base Line Measurement, Triangulations, Adjustment of simple figures, Computation of coordinates, Map Projections; Precise levelling; Observations for Azimuth, Latitude, Time. Introduction to adjustment of observations. Outlines of D.L.S. and O.L.S. systems. Descriptions.

PRACTICE. Field work in stadia survey, triangulations, mine surveying, levelling, observations.

Lecture—Thursday, 10-11.

Field Work and Draughting—Tuesday, 1-4. Professor Ellis.

Text-book—Breed & Hosmer.

SURVEYING V.

For students in Courses A and C, third year.

Dominion Land Surveying, comprising the methods adopted in Survey of Dominion Lands as laid down in Manuel of Survey, issued 1918 by the Dominion Government. Determination of Latitude, Azimuth and Time.

Ontario Land Surveying.

Underground Surveying. Principles involved in Mine Surveys and problems connected with underground work.

Topographic Surveying—Extension of work taken in Surveying III.

Lecture—Tuesday, 11-12, first term.

Field Work—Saturday, 9-12. first term only. Professor Malcolm.

Text-book—Johnston and Smith, *Surveying.*

Books of Reference—Surveys Act, Ontario.
Manual of Survey, D.L.S.

ELECTRICAL ENGINEERING.

PROFESSOR—D. M. Jemmett, M.A., B.Sc.

LECTURER—D. G. Geiger, B.Sc.

DEMONSTRATOR—H. J. D. Minter, B.Sc.

ELECTRICAL ENGINEERING I.

FUNDAMENTAL PRINCIPLES.

For third year students in Courses A, D, E and F.

The electric circuit. The magnetic circuit. Generated and induced electro-motive forces. Self and mutual induction. Elementary theory of alternating and direct current generators and motors. Common systems of transmission and distribution of electric current. General principles of illumination. Storage batteries.

Lectures—Monday, 8-9, first term; 10-11, second term; *Friday,* 10-11.

Laboratory—Monday, 1-3, Courses E, F. *Monday,* 3-5, Courses A, D.

Prof. Jemmett.

ELECTRICAL ENGINEERING II.

For third year students in Courses G and H.

Alternating currents. Laws governing the flow of current in circuits containing resistance, inductance and condensance. The use of the complex quantity. The theory, construction and operation of the transformer. Meters and the measurement of electrical quantities.

Lectures—Thursday, 11-12; *Saturday,* 9-10.

Laboratory—Saturday, 10-12. Professor Jemmett and Mr. Minter.

ELECTRICAL ENGINEERING III.

For third year students in Course G.

The electric and magnetic circuits, hysteresis and hysteresis loss. Measurement of magnetic quantities. Some simple transients. Theory of direct current generators and motors. Series, shunt and compound machines. Energy losses, efficiency and commutation, methods of control, Storage batteries. Application of direct current in commercial work. Illumination and photometry.

Lectures—Monday, 9-10; *Wednesday,* 11-12; *Thursday,* 10-11.
Mr. Geiger.

Laboratory—Tuesday, 1-4. Mr. Geiger and Mr. Minter.

ELECTRICAL ENGINEERING V.

For fourth year students in Course G.

Theory of alternating current generators, Synchronous and Asynchronous Motors. Rotary Converters. Potential Regulators. Phase changing. Multiphase Systems. Transmission of power. Applications of alternating current in commercial work.

Lectures—Monday, 11-12; *Tuesday,* 10-11; *Thursday,* 10-11; *Friday,* 11-12. Professor Jemmett.

Laboratory—Thursday, 1-4; *Friday,* 1-4.
Professor Jemmett and Mr. Minter.

ELECTRICAL ENGINEERING VII.

A special course for fourth year students in Course F.

Lecture—Wednesday, 1-2, Mr. Geiger.

Laboratory—Wednesday, 2-4. Mr. Geiger and Mr. Minter.

ELECTRICAL ENGINEERING VIII.

For Fourth year students in Courses G. and H.

Exact solution of transmission lines in the steady state. The general differential equation. Solution in hyperbolic functions. Free, grounded

and loaded lines. Nominal and Equivalent π and T lines. Use of complex circular and hyperbolic tables and charts. Solution of power and telephone lines.

Lecture—Tuesday, 9-10.

Laboratory—Monday, 1-4. Professor Jemmett.

ELECTRICAL ENGINEERING IX.

For Fourth year students in Course G.

Advantages and Disadvantages of Electric Traction. Electric Motors available for Traction Work. Motor Cars and Electric Locomotives. Methods of Control. Comparison of Characteristics of Steam and Electric Locomotives. Power required for various classes of service. Brakes and Braking. Transmission and Distribution of Power for Traction Purposes.

Lectures—To be arranged.

Laboratory—Monday, 1-4. Professor Jemmett.

ELECTRICAL ENGINEERING X.

For fourth year students in Course G.

Design and Calculation of performance of transformers, generators, and motors.

Lecture—Wednesday, 11-12.

Draughting Room—Tuesday, 1-4, Professor Jemmett and Mr. Geiger.

ELECTRICAL ENGINEERING XI.

For fourth year students in Course G.

The Morse System. Repeaters. Duplex and Multiplex Systems. Combination Systems. Automatic and Printing Telegraph. Railway Block Systems. Modern Telephone Systems. Wireless Telegraphy and Telephony. Simultaneous Telegraphy and Telephony.

Lecture—To be arranged.

Laboratory—Monday, 1-4. Mr. Geiger.

ELECTRICAL ENGINEERING XII

Required of Fourth year students in Courses G and H.

A Course on fundamental principles of Thermonics with special reference to electron tubes. Applications of electron tubes to radio, carrier current telephony, and power uses are considered and discussed.

Lectures—Wednesday, 10-11; *Thursday,* 9-10.

Laboratory—Saturday 9-12; second term.

Mr. Geiger.

ELECTRICAL ENGINEERING LABORATORIES.

Laboratories Nos. 1, 3, and 4 are equipped with standard types of direct and alternating current machines which include synchronous motors and gen-

erators, rotary converters, polyphase induction motors, repulsion and compensated induction motors, constant current transformers, series and potential transformers, power transformers, direct current shunt, series and compound wound machines. A complete set of rheostats and brakes with all necessary meters are available for determining the performance of these machines.

Laboratory No. 4, is also equipped with two high voltage D.C. generators. giving potentials up to 3000 volts, a 500 cycle inductor alternator and a high current low voltage generator giving current up to 800 amperes for calibration purposes.

Laboratory No. 5 is fitted with a photometer and standard lamps. A Duddell oscillograph is available for the determination of wave forms and transient phenomena. This laboratory also has a complete equipment of standard precision instruments for making all exact electrical measurements.

Laboratory No. 6 contains the experimental transmitting station C.F.R.C. There is also a receiving set of very flexible design. This laboratory in addition to being a Radio laboratory is used for the study of the characteristics of electron tubes as generators oscillators and amplifiers. A number of tubes with the necessary variable condensers, reactors, A and B batteries, and wavemeter are available. Direct current up to 3000 volts and 0.40 amperes is provided for plate voltages..

Laboratory No. 2, contains the storage battery and balancer set control panels and a transformer giving voltages up to 100,000 volts. A sphere gap and pan type electrostatic voltmeter are available for measuring high voltages and a number of insulators suitable for testing are on hand.

Power is available from the University Plant at 220/110 volts D.C. direct or through a motor—generator set which delivers power at 120/60 volts D.C. and 2 phase 85 volts 25 cycles A.C. A 125 volt, 200 ampere hour storage battery and city power at 3 phase 220/110 volts 60 cycles are also provided.

A large number of circuits which have terminals in the various laboratories enable power to be easily transferred from any machine to any other machine.

The University Power Plant is a combination direct and alternating current system making available for study and observation such apparatus as D.C. generators, synchronous motors, Tirril regulators, balancer sets, storage batteries, power transformers, watthour meters, boosters, switchboard apparatus, etc.

The city of Kingston has a new and up to date hydro-electric station, to which visits are made for instruction and observation.

MECHANICAL ENGINEERING.

PROFESSOR—L. M. Arkley, M.Sc.

ASSOCIATE PROFESSOR—L. T. Rutledge, B.A., Sc.

MECHANICAL ENGINEERING I.

ELEMENTS OF MACHINE DESIGN.

For students in Courses F, and G, third year; Course D, third year, first term.

The work in this class comprises a study of the following:— Characteristics of materials used in machine construction; a review of the principles of simple stress and bending moments, their application to beams, columns and machine fixtures; principles governing design, selection of working stresses; and horizontal and vertical shear and compound stress; distribution of stress in machine parts; analysis of stress and design of fixtures; for example, rivetted connections, bolts, nuts, screws, keys, cotters and pins; analysis of stress in simple shafting, crank shafts on two bearings; shaft couplings; miscellaneous problems of design, i.e. design of wall brackets, bases and frames for machinery; bearings; graphical solutions applicable in design, i.e. Mohr's Method of determining the position of the Centre of Gravity and Moment of Inertia of a complex section; study of manufacturing and machine processes as applied to the manufacture of machinery.

Lectures—Tuesday, 11-12; *Wednesday,* 8-9. Professor Rutledge.

Text-books—Leutwiler, *Machine Design;* Marks, *Mechanical Engineer's Handbook.*

MECHANICAL ENGINEERING II.

TRANSMISSION OF POWER IN MACHINERY.

For students in Courses F, and G, third year.

The work in this class consists of analysis of stress in and design of power transmission systems, comprising belt, rope, chain and gear drives; study of couplings, friction clutches and brakes.

Lectures—Monday, 11-12 and *Friday,* 11-12; second term only.
Professor Rutledge.

Text-book— Leutwiler, *Machine Design;* Leutwiler, *Text of Problems,* Mark, *Mechanical Handbook.*

MECHANICAL ENGINEERING III.

PRACTICAL MACHINE DESIGN.

For students in courses F and D, third year.

This course is a practical application of work taken up in Mechanical Engineering I. and II., which courses are prerequisites of the course Mechanical III.

Draughting—Wednesday, 1-4, F; *Thursday,* 1-4, F; *Wednesday,* 1-4, D, first term. Professor Rutledge.

MECHANICAL ENGINEERING IV.

The Elements of the Power Plant.

For students in Course F, third year and students in Courses A, D and E, fourth year.

This course covers the following:—Fuels and combustion; transfer of heat; heating surface; generation of steam; types of boilers; chimneys; artificial draft; smoke prevention; mechanical stoking; coal handling; use of superheated steam; feedwater heaters; condensing systems; pumping machinery; compressed air; gas and oil engines; gas producers and heating systems.

Lectures—Thursday, 9-10, A, D, E, F;
Wednesday, 11-12,F, (a) ;*Tuesday,* 10-11, A. D. E. (a).

Professor Arkley.

MECHANICAL ENGINEERING V.

Advanced Machine Design.

For students in Course F, fourth year.

This course consists of a more rigorous treatment of the elements of Machine Design and a more intensive study of simple and compound stress. The effect of curvature of stress lines is studied and applied to the design of curved beams, crane hooks, punch press frames; the study of stress in crank shafts is continued and applied to multiple cylinder crank shafts with more than two bearings.

The following subjects are treated fully:—Eccentric loading in various forms; the forces acting on moving parts in machinery including frictional forces involving the study of kinetics; analysis of stress in automobile parts and in machine tools; analysis of stress in a member which does not consist of one homogenous material; design of helical, spiral and leaf springs; lubrication and lubricating oils; bearings of all types; flywheels; interaction of motor and flywheel in a flywheel drive.

Jigs, dies and fixtures design. This part of the course treats of the fundamental principles of tool design and the application of the principles; heat treatment of steel from a mechanical engineering standpoint.

Lectures—Tuesday 10-11, *Wednesday,* 11-12, *Thursday,* 11-12.

Professor Rutledge.

Laboratory—Monday, 1-4, *Tuesday,* 1-4.

Text books—Reference Books in Mechanical Library and Technical Journals.

MECHANICAL ENGINEERING VI.

DESIGN OF POWER PLANTS, HEATING, VENTILATING AND REFRIGERATION.

For students in Course F, fourth year.

This course deals with the following:—The proportioning and selection of elements and their combination in steam power plants to obtain the maximum profit from investment and operation. Theoretical and practical principles governing the design and operation of gas producer plants. Power plant testing methods and apparatus.

Heat losses from buildings; design of hot air, hot water and steam heating systems. Discussion of refrigeration systems.

Lectures—Thursday, 10-11 and *Tuesday,* 9-10, first term.

Professor Arkley.

Text-books—Reference books in Library, Hoffmann, *Heating and Ventilating.*

MECHANICAL ENGINEERING VII.

PRACTICAL MACHINE DESIGN.

For students in Course G, third year.

This course is a practical application of work taken up in Mechanical I and II which courses are pre-requisites of the course.

Draughting—Thursday, 1-4. Professor Rutledge.

MECHANICAL ENGINEERING VIII.

FUEL TESTING.

For students in Course F, fourth year.

This course covers the following:—

Testing of fuels, gaseous, liquid and solid, with respect of their suitability for power generation. Gas and fuel analysis. Calculation and calorimetric determination of the heating value of fuels. Gas analysis in connection with the operation of steam boilers, gas and gas producers. Physical tests of lubricants. Causes and prevention of boiler scale. Treatment of feed-waters.

Laboratory—Saturday, 9-12, second term.

Professor Arkley and Demonstrator.

MECHANICAL ENGINEERING IX.

KINEMATICS OF MACHINERY.

For students in Courses E, F, and G, second year.

This course treats of the theory of mechanisms with special attention to the following: The nature of a machine; uniform and variable motions in machines; velocity diagrams, motion diagrams using the phorograph method; applications to various mechanisms found in engines, locomotives and machinery.

The design of gears and cams are treated from first principles including development and design of tooth profiles for cycloidal involute and stub teeth; simple, compound and epicyclic gear trains and proportioning of speeds in machine tools.

Lecture—Tuesday, 9-10.
Draughting—Thursday, 1-3.

Professor Rutledge and Demonstrator.

Text-book—Angus, *Theory of Machines.*

MECHANICAL ENGINEERING XI.

Internal Combustion Engines.

For students in Course F, fourth year.

This course consists of the design of gas, gasoline and oil engines, suitable for use in automobiles, tractors and stationery engines.

Lecture—Friday 9-10, *Tuesday,* 9-10, second term only.

Text-book—Streeter, *Internal Combustion Engine.*

Professor Arkley.

THERMODYNAMICS I.

Elementary Thermodynamics.

For students in Courses A, D, E, F, and G, third year.

The course consists of a study of the following;—Fundamental laws of Thermodynamics; specific heats; special changes of state, i.e., constant volume, constant pressure, isothermal, adiabotic, polytropic; ideal cycles with perfect gases. Carnot, Stirling and Ericsson cycles; air compression, work and temperatures, maximum economy of compression; thermal properties of saturated vapors and of vapor and liquid mixtures; properties of steam; use of steam tables; miscellaneous type problems on the above.

Lectures—Monday, 10-11, *Friday,* 9-10; first term. Professor Rutledge.

THERMODYNAMICS II.

Mechanics of Machinery.

For students in Courses F, and G, third year.

This course furnishes a treatment of the following;—Crank effort and turning moments in steam engines; governors; speed fluctuation in machinery; kinetic energy of machines, including effects of inertia; proper weight of fly wheels; accelerations in machinery and their effects; forces in machines and efficiency of members; graphical constructions; disturbing forces; stresses due to inertia; balancing of machinery.

Lecture—Friday, 9-10, second term.

Text-book—Angus, *Theory of Machines.*

Professor Rutledge.

THERMODYNAMICS III.

ADVANCED THERMODYNAMICS.

For students in Courses F, and G, fourth year.

This course treats of the following:—Theory of refrigerating machines and systems. Entropy and entropy-temperature diagrams. Superheated steam. Performance of actual engines. Influence of size, speed, valve gear and ratio of expansion on economy. Steam jackets, Compound and triple expansion engines. Advanced theory of gas and oil engines. Action of steam upon turbine buckets. Flow of steam through nozzles, orifices, and turbine passages, Effects of friction on flow. Types of steam turbines, and their operation.

Lectures—Monday, 10-11; *Tuesday,* 11-12.
Laboratory—Saturday 9-12, first term.

Professor Arkley.

Experiments in Thermodynamic Laboratory and local power plants.

THERMODYNAMICS IV.

ADVANCED THERMODYNAMIC LABORATORY WORK.

For students in Course, F, fourth year.

This course consists of advanced engine and power plant testing.

Laboratory—Friday, 10-12, 1-4.

Professor Arkley and Demonstrator.

THERMODYNAMICS V.

VALVE AND VALVE GEARS.

For students in Course, F, third year.

This course consists of a study of the design and action of slide, coreless, piston and poppet valves, etc., valve diagrams; fixed and reversible gears, valve governors, valve operating cams and eccentrics. The lecture work is carried on in conjunction with draughting room exercises and practical valve setting on laboratory apparatus.

Lecture—Monday, 9-10.

Laboratory—Tuesday, 1-3.

Professor Arkley and Demonstrator.

THERMODYNAMICS LABORATORY.

Thermodynamics Laboratories are now divided into two sections, first the Internal Combustion Engine laboratory in Fleming Hall and second the steam laboratory located at the New Central Heating Plant. The equipment of the former includes a producer gas engine unit complete, a four stroke cycle oil engine, a two stroke cycle gasoline engine, several gasoline engines of different types, and a semi-Diesel Hoag engine and several aeroplane engines.

The steam laboratory proper containing a number of types of steam engine, an air compressor, a condenser and pump, injector testing equipment, etc.

The work in this laboratory is given in connection with the Central Heating Plant where the auxiliary equipment such as steam turbines, centrifugal and reciprocating pumps, water tube and fire tube boilers and feed-water heaters are all available for study and investigation by the students, they having been designed with this object in view.

A valuable feature in connection with this plant is the study of different methods of heating as carried out from one Central Plant. The whole plant is conveniently equipped for making overal efficiency tests under practical working conditions.

The boilers are equipped with superheaters which makes investigations on the important question of superheated steam possible.

SHOP WORK

INSTRUCTORS—A. C. Baiden, Machine Shop.
W. E. Connolly, Blacksmith Shop.

For students in Courses E, F, and G, second year; Course F, third year; Course Dc., fourth year.

Students in courses F and G shall enter any commercial works approved by the School and take a special course of shop training extending over a period of thirty-six weeks (18 weeks between second and third, and 18 weeks between third and fourth college years; or, in case accommodation cannot be secured, they shall attend a special course in the workshops of the School, extending over a period of 8 weeks (4 weeks preceding their third college year and 4 weeks preceding their fourth college year).

A student in Course H. shall enter any commercial works approved by the school and take a special course of shop training extending over a period of 12 weeks, between the second and third years of his course.

To ensure that as many students as possible will have an opportunity to obtain their shop training in commercial works, arrangements have been made with the management of several of the large manufacturing establishments, so that the students who have completed their second year, may enter upon a suitable course of shop training and receive such remuneration as will more than cover their expenses. In this case the student must present a certificate from the manager of the works in which he has carried out his practical work, stating the character of the work done and the amount of time spent in the various departments.

The student must present the certificate to the Professor of Mechanical Engineering who has general supervision over all shop work.

A complete forge shop has been added to the equipment, so that now efficient instruction can be given in machine shop practice, and in blacksmithing. The forge shop is located in the basement of the workshop building, and is equipped with the latest type of downdraft forges, and electric drive for the blower and exhauster.

Students in all courses will be given a course of practical work in workshops of the School as per schedule of courses.

Work Shop—*Monday,* 1-4, second year, E, F, and G.
Wednesday—1-4, second year, E.F.G.
Saturday—9-12, third year, F.
Friday—1-4, fourth year, Dc.

DRAWING.

Assistant Professor—A. Jackson, B.Sc.

All drawings are to be drawn in the drafting room assigned. Drawings made by the students are considered the property of the department, and must not be taken from the drafting room until the close of the spring session.

DRAWING I.

For all first year students.

The lectures and practical work are arranged with the view of preparing the student for the subject of Engineering Drawing.

Each student at the opening of the term must provide himself with a set of drawing instruments of approved standard.

The class standing will be determined by the term's work.

The work will consist of (*a*) Free-hand lettering adapted to working drawings; (*b*) Geometrical drawing and simple working drawings, tracing and blue printing.

Sections 1, 2, *and* 3,—*Wednesday,* 1-4, *Thursday,* 1-3.
Section 4, *Monday,* 1-3, *Tuesday,* 1-4.

Professor Jackson

Text-book—French, *Manual of Engineering Drawing.*

DRAWING II.

For students in Courses A, B, C, and D, second year.

The work will include structural and machine drawing, assembly drawings, detail drawings from free-hand sketches of details of machines, tracing and blue-printing.

The class standing is determined by the term's work.

Tuesday, 1-3; *Saturday,* 9-12; second term. Professor Jackson.

Text-book—French, *Manual of Engineering Drawing.*

DRAWING III.

For students in Courses, E, F, and G, second year.

A more extended course than as outlined in Drawing II.

The class standing is determined by the term's work.

Tuesday, 3-5, first term; *Tuesday,* 1-3, and *Saturday,* 9-12, second term.

Text-book—French, *Manual of Engineering Drawing.*

PROJECTION.

For first year students in all courses.

A course in the principles of Orthographic, Axonometric and Isometric Projections applying Descriptive Geometry to the representation of the more familiar rectilinear and curvilinear solids, in sections and intersections and the development of their surfaces.

Division of space into four quadrants. Projection of a point in the four quadrants. Representation of infinite planes. Projections of lines on auxiliary planes. Intersection of planes. Traces of lines and planes. Rotation of points and planes about a fixed axis. True length of a line. Inclination of a plane to the horizontal and vertical planes of projection.

Sections 1 *and* 2, *Monday,* 1-3; *Sections* 3 *and* 4, *Monday,* 3-5.

Professor Jackson

DESCRIPTIVE GEOMETRY.

Required of all second year students.

A continuation of the latter part of the course in Projection. Shortest distance of a point to a line, angle between intersecting lines and planes. Projection of a solid figure on any oblique plane. Intersection of a line and a plane. Perpendicular to a plane. Shortest distance between two lines not in the same plane. Angle between line and plane. Application of Projection principles to the solution of problems in guide pulleys. Shadows thrown by lines, planes and solids. Shades and shadows of cones, pyramids, etc.. on one or more planes. Perspective representation of points, lines and solids.

The students are drilled in the subject by numerous applications in the drafting room.

Tuesday, 1-3, *Saturday,* 9-12, first term, Professor Jackson.

Text-book—Smith, *Practical Descriptive Geometry.*

PHYSICAL TRAINING.

Physical Director—James G. Bews.

Medical Advisor—H. S. Angrove, M.D.

Each first year student is given a physical examination by the Medical Adviser and corrective exercises in the gymnasium are prescribed when they are needed.

Gymnasium work for two hours each week is required of all first year students except those excused by the Medical Adviser. Voluntary classes are offered other students. The physical drill consists of progressive series of exercises with dumb bells, Indian clubs, bar bells, and chest weights, combined with marching tactics and free setting-up exercises; also apparatus work on long horse, parallel bars. ladder and horizontal bar.

A wide option is allowed and equivalent credit is given for attendance at gymnastic classes or during active membership on the football, hockey, basketball, or track teams, and in the fencing wrestling and boxing clubs, of the University. Credit is also given to those electing to take C.O.T.C. training in place of regular gymnastic work.

The gymnasium is a modern stone building 60 x 105 ft. and is equipped with lockers, shower-baths, a swimming pool, running track, and all apparatus for physical training.

Hospital Privileges

By regulation of the Senate all students who register in the University must pay a fee of $4.00 towards a health insurance fund which is used by the University to provide medical care for those who are ill. Details of this plan will be available at Registration.

Athletics

As a member of the Canadian Intercollegiate Amateur Athletic Association, Queen's gives every opportunity for students to compete in intercollegiate athletics on some of the many teams representing the University, while the student who is not a good enough athlete to find a place on a University team has the chance to play in inter-year and inter-faculty games.

All athletic activities are controlled by the Athletic Board of Control, consisting of twelve members—four graduates, four Professors, and four undergraduates. Two of the Professors and the four undergraduate members are elected by the student body. This Board controls the rink, the playing fields, and the gymnasium, and has a supervision and power of veto over the management and expenditure of the rugby, soccer, hockey, basketball, tennis, track, swimming, boxing, fencing, and wrestling clubs.

Through the generosity of Mr. James Richardson, of Kingston and Winnipeg, a graduate in Arts of the University, a new stadium was com-

pleted during the summer of 1921. It is situated on the Union Street Campus and is known as the George Richardson Memorial Field. The grand-stand is of steel and concrete construction, containing ample accommodation for players, and seating 2,000 spectators. The bleachers accommodate 1,700. The playing field is unexcelled by any in Canada. Within the stadium is also a cinder track 15 feet wide with a straight-away of 100 yards, 20 yards wide. An additional rugby field will also be built outside the stadium to care for the overflow from the first and second team practices. Soccer is played on the campus in front of the Arts Building.

The Jock Harty Arena was destroyed by fire, but was at once replaced and an artificial ice-plant installed.

LIBRARIES.

The University Library was removed from the Old Arts Building to the new Douglas Library Building during the Summer of 1924. The new building provides one large reading room, three smaller ones, a number of conference rooms, exhibition room and offices for the library and administrative staff.

In the main reading room will be found a collection of some 5,000 volumes of general reference works on open shelves. The main collection is shelved on five tiers of book-stack, occupying the centre of the building and under the main reading room. The general library now comprises in excess of 150,000 volumes as well as many original manuscripts and prints.

The system of classifiction used is that of the Library of Congress.

750 journals and other serials are being currently received.

The Lorne Pierce Collection of Canadian Literature is very rich in first editions, original manuscripts and rare Canadiana.

The Shortt-Haydon Collection of portraits and views relating to Canada is the second finest collection of its kind in existence.

In addition to the general library there are departmental libraries for physics, chemistry, mining and metallurgy, geology and mineralogy, civil, mechanical and electrical engineering.

ENGINEERING SOCIETY.

The representative student organization of the Faculty of Applied Science is the Engineering Society. All students registered in the Faculty of Applied Science are members of this society. Regular monthly meetings are held and the society has been very fortunate, in recent years, in securing successful engineers to address the students during the session. Any student member who wishes to read a scientific paper before the society will always find the executive of the Engineering Society ready and willing to arrange a date. Prizes are offered in connection with such student papers.

The Engineering Society and the graduates and alumni issue annually a publication containing a complete list of all the graduates, and a list of all students registered in the Science Faculty and a record of all matters in con nection with the Engineering Society.

An Employment Bureau has been established and a permanent Manage engaged. The objects of the Bureau are to obtain suitable positions for graduates and for students during the summer vacations and to put graduates and employers, engineers, chemists, etc., in touch with each other for their mutual advantage. Communications should be addressed: Manager, Employment Service, Queen's University.

The Society conducts a Technical Supplies Department, where all books prescribed, stationery, note books, drawing paper and instruments, and all other supplies, may be purchased at prices but slightly over cost. Any books not in stock will be ordered on payment of a small deposit.

SCHOLARSHIPS IN SCIENCE

Awarded 1926.

First Year Scholarships.

The Sir Sandford Fleming Scholarship $70
D. S. Burke, Ottawa, Ontario.

The Robert Bruce Scholarship $89.75
B. S. Taylor, Ottawa, Ontario.

N. F. Dupuis Scholarship $60
A. R. Williams, Oshawa, Ontario.

Second Year Scholarships.

The P. D. Ross Scholarships ..... Values $100 and $50
First—G. McR. Minard, Ottawa, Ontario.
Second—K. R. MacGregor, Ottawa, Ontario.

Third Year Scholarships.

Kenneth B. Carruthers Scholarships in Mining and Metallurgy ..... Value $137.50 each.
Mining—N. S. Beaton, Haileybury, Ontario.
Metallurgy—J. N. Anderson, Ottawa, Ontario.

Prizes.

Segsworth Prize—Essay: Subject: "Drifting at the Keeley Mine."
B. E. Weir, Woodstock, Ontario.

Bell Memorial Prizes—Second Year.
First—J. C. S. Honsberger, Welland, Ontario.
Second—H. R. Fowlie, Kingston, Ontario.

Bell Memorial Prizes in Third Year for Essays.
First—J. M. Hamilton, Vars, Ontario.
Subject: "The Lake Shore Mine."
Second—J. A. Little, Allandale, Ontario.
Subject: "The Creighton Mine."

E. T. Sterne Prize in Chemical Engineering.
W. M. Reid, Kingston, Ontario.

Medal.

Governor-General's Medal.
Keith Abbott MacKinnon, B.Sc., Kingston, Ontario.

DEGREES AWARDED IN THE FACULTY OF APPLIED SCIENCE, 1926

Degree of M.Sc.

Name	Address
Boyd, Ivan William, B.Sc.	Sault Ste. Marie, Ontario.

Degree of B.Sc. with Honours

Chapman, Francis Herbert	Kingston, Ontario.
Grant, LeRoy Fraser	Kingston, Ontario.
Marion, Leo Edmond	Ottawa, Ontario.
Muirhead, Arnold Gillies	Carleton Place, Ontario.
McDonald, Donald John	R.R. 1, Dalhousie Station, Quebec.
MacDonnell, Gordon Frederick	Perth, Ontario.
MacKinnon, Keith Abbott	Kingston, Ontario.
MacLeod, Donald Ridgway	Kingston, Jamaica.
Robb, Robert Edmund	Evansville, Indiana.
Roney, Gerald VanLuven	Kingston, Ontario.
Sawyer, William Reginald	Kingston, Ontario.

Degree of B.Sc. Pass.

Airth, William Bertram	Toronto, Ontario.
Bawden, William Ewart	Kingston, Ontario.
Beaton, William Walsh	Haileybury, Ontario.
Boag, Ernest C.	Ottawa, Ontario.
Bromley, Arthur William John	Sudbury, Ontario.
Brookins, Harry	Ottawa, Ontario.
Burley, Joseph Gerald	R.R. 4, Picton, Ontario.
Clemence, Aubrey LeRoy	Bronte, Ontario.
Clement, Arthur G.	Chapleau, Ontario.
Davis, Warren C.	Sudbury, Ontario.
Davison, Charles Fraser	Windsor, Ont.
Gillespie, Wilbur Frederick	Calgary, Alberta.
Hartman, Hilbert John	Kingston, Ontario.
Haslam, Harold	Niagara Falls, Ontario.
Jerome, James Edward	Cornwall, Ontario.
King, Norman Harrington	Timmins, Ontario.
Kurtz, Harold John Thomas	Burlington, Ontario.

Mathieson, Thomas Stanley ..... Beachburg, Ontario.
Morgan, Edwin Owen ..... Box 178, Delhi, Ontario.

McBride, George Clarke ..... Carp, Ontario.
McClory, Francis Cyril ..... Lindsay, Ontario.

Neilson, Charles Shibley ..... Wilton, Ontario.
Norrie, Joseph Ronald ..... Truro, Nova Scotia.

Reid, Wallace Middleton ..... Kingston, Ontario.
Richards, William Alexander ..... Hamilton, Ontario.
Richardson, William Gordon ..... Watford, Ontario.
Rooney, Travers Dyson Kendrick ..... Kingston, Ontario.
Rystogi, Clifford Andrew ..... Dawson, Yukon.

Snyder, Horace Hemstreet ..... North Bay, Ontario.
Stewart, Harold Huton ..... Kingston, Ontario.
Stewart, Harvey Weeden ..... Owen Sound, Ontario.

Taylor, Alan David ..... Box 149, Beamsville, Ont.
Traves, John Rosswell ..... Kingston, Ontario.

Weir, Ernest Beverley ..... R.R. 5, Woodstock, Ontario.
Wright, William Edward ..... Kingston, Ontario.

LIST OF STUDENTS

In Attendance Session, 1926-27

FACULTY OF APPLIED SCIENCE.

FIRST YEAR

Name	Address
Abbott, D. S.	Toronto, Ontario.
Adams, G. W.	Toronto, Ontario.
Ames, H. L.	Plainville, Ontario.
Arkley, L. M.	Kingston, Ontario.
Armstrong, W. H.	Cobourg, Ontario.
Baley, J. R.	Welland, Ontario.
Ball, E. G.	Brandon, Manitoba.
Barton, E. A.	Ogdensburg, N.Y.
Bassermann, R. R.	Montreal West, Quebec.
Book, C. F.	Smithville, Ontario.
Bowker, C. E. J.	Thorold, Ontario.
Bowles, J. R.	Bradford, Ontario.
Bryant, W. E.	Petrolea, Ontario.
Burgess, T. J.	Ottawa, Ontario.
Carpenter, G. A.	Windsor, Ontario.
Chapman, S. L.	Gananoque, Ontario.
Cleland, W.	Kingston, Ontario.
Cohen, H. A.	Kingston, Ontario.
Cooper, W. R.	Island Pond, Vermont.
Craig, H. B. R.	London, Ontario.
Daly, J. M.	Parry Sound, Ontario.
Dickey, H. P.	Hamilton, Ontario.
Dore, J. I.	Ottawa, Ontario.
Drewry, G. D.	Stirling, Ontario.
Edmonstone, R. S.	R.R. 1, Kemble, Ontario.
Elliott, J. S.	Kingston, Ontario.
Evans, J. H.	Cobalt, Ontario.
Eynon, D. J.	Ottawa, Ontario.
Farnsworth, D. A.	Cookshire, Quebec.
Farquharson, A. G.	Brockville, Ontario.
Ferris, V. G.	Port Rowan, Ontario.
Florence, M.	Merritton, Ontario.
Franklin, G. A.	Vankleek Hill, Ontario.
Franklin, L.	Maxville, Ontario.
Garrison, D. H.	R.R. 5, Belleville, Ontario.
George, M. B.	Listowel, Ontario.
Goodman, J. E.	Montreal, Quebec.
Gorie, R. H.	Beachburg, Ontario.

Hall, D. D. ..... Fenwick, Ontario.
Hancock, J. A. ..... Leamington, Ontario.
Harrison, W. E. ..... Parkhill, Ontario.
Houston, J. C. ..... Jordan Station, Ontario.
Hughes, F. W. ..... North Bay, Ontario.

Jack, D. ..... Hamilton, Ontario.
James, F. E. ..... London, Ontario.
Jarvis, G. W. ..... Hamilton, Ontario.

Keddie, W. M. ..... Ottawa, Ontario.
Kilgour, W. J. ..... North Bay, Ontario.
Kilpatrick, J. M. ..... Sudbury, Ontario.
King, P. C. ..... Toronto, Ontario.

Lalande, A. M. ..... Box 313, Cobourg, Ontario.
Leavens, J. ..... Bloomfield, Ontario.
Lockhart, W. W. ..... Ottawa, Ontario.
Logan, J. A. ..... Yorkton, Saskatchewan.

Malkin, J. G. ..... Amigari, Ontario.
Millar, J. D. ..... Brockville, Ontario.
Miller, C. ..... R.R. 7, Watford, Ontario.
Mumford, E. E. ..... Worthington, Ontario.
MacDermid, B. G. ..... Martintown, Ontario.
McDonell, M. ..... R.R. 1, Dalhousie Station, Quebec.
MacEwen, S. ..... Fredonia, N.Y.
McIntosh, P. ..... Vankleek Hill, Ontario.

Pitt, S. R. ..... Brinston, Ontario.

Rabb, A. H. ..... Perth, Ontario.
Ransom, F. C. ..... Burntisland, Fife, Scotland.
Reid, J. N. ..... Belleville, Ontario.
Revell, G. A. ..... Ottawa, Ontario.
Richardson, G. A. ..... Kingston, Ontario.
Rombough, M. ..... Oshawa, Ontario.
Rosseter, F. S. ..... Chapleau, Ontario
Russell, O. S. ..... Delta, Ontario.
Ryan, J. P. ..... Crystal Beach, Ontario.

Spence, G. H. ..... Ottawa, Ontario.
Stanbury, C. M. ..... St. Thomas, Ontario.
Stevenson, G. C. ..... Regina, Saskatchewan.
Stott, D. A. ..... St. Thomas, Ontario.

Taylor, H. F. ..... Blyth, Ontario.
Taylor, J. B. ..... Blyth, Ontario.
Thomas, J. L. ..... Ottawa, Ontario.
Thompson, A. H. A. ..... Lynden, Ontario.

Vout, T. R. ..... Brockville, Ontario.
Voaden, N. R. ..... Port Stanley, Ontario.
Voss, C. P. ..... Toronto, Ontario.

Walker, R. S. ..... Barrie, Ontario.

Yong, M. ..... Hamilton, Ontario.

Second Year.

Acton, W. A. ..... Brockville, Ontario.
Agnew, T. C. ..... Toronto, Ontario.
Ashworth, W. W. ..... Hamilton, Ontario.

Baker, C. M. ..... Hastings, Ontario.
Bootes, C. J. ..... Smith's Falls, Ontario.
Bulmer, H. ..... Forester's Falls, Ontario.
Burbank, E. F. ..... Toronto, Ontario.
Burke, D. T. ..... Ottawa, Ontario.
Burns, E. D. ..... Brockville, Ontario.
Bushlen, H. E. ..... Brantford, Ont.

Clark, L. D. ..... Kingston, Ontario.
Corneil, E. R. ..... Omemee, Ontario.
Corneil, R. B. ..... Omemee, Ontario
Craighead, D. H. ..... Campbellford, Ont.
Cranston, P. G. ..... Arnprior, Ont.

Dalton, W. R. ..... Box 623, Burlington, Ontario.
Doak, F. C. ..... Lansdowne, Ontario.
Durham, G. D. ..... Niagara Falls, Ontario.

Eamon, J. H. ..... Wales, Ontario.
Elliott, R. G. ..... Norwood, Ontario.

Fairbairn, H. W. ..... Ottawa, Ontario.
Findlay, R. A. ..... Kingston, Ontario.
Forsyth, L. ..... Carnduff, Sask.
Fowlie, C. W. ..... Kingston, Ontario.
Frisken, O. J. ..... Napanee, Ontario.

Gaetz, T. M. ..... Box 690, Red Deer, Alberta.
Gardiner, R. C. ..... Kingston, Ontario.

Hall, J. R. ..... Aldershot, Ontario.
Hambly, J. M. ..... Copper Cliff, Ont.
Hart, W. O. ..... Oshawa, Ontario.
Heilig, C. G. ..... Hamilton, Ontario.
Henderson, J. F. ..... Ottawa, Ontario.
Hickman, T. E. ..... Ottawa, Ontario.
Hilton, L. A. ..... Kingston, Ontario.
Horton, A. R. C. ..... Ingersoll, Ontario.

Jenkins, W. S. ..... Madoc, Ontario.
Jones, J. F. ..... London, Ontario.

Ketiladze, G. S. ..... Tiflis, Caucausus.

LaMonte, H. J. ..... Niagara Falls, Ontario.
Little, W. C. ..... Leamington, Ontario.

Mather, K. R. ..... Toronto, Ontario.
Mill, G. L. ..... Quebec, P.Q.
Miller, C. H. ..... Ottawa, Ontario.
Miller, W. F. ..... North Bay, Ontario.
Minns, H. C. ..... Kingston, Ontario.
Munger, K. H. ..... Hamilton, Ont.

MacDonald, C. W. ..... Box 183, Goderich, Ontario.

Nagel, M. E. ..... Crystal Beach, Ontario.
Newkirk, T. E. ..... Simcoe, Ontario.

Parliment, H. ..... Woodville, Ontario.
Phelan, M. A. A. ..... North Sydney, N.S.
Pooler, G. D. ..... Woodroffe, Ontario.
Pound, W. T. ..... Kingston, Ontario.

Quinn, A. F. ..... Deloro, Ontario.

Rabeau, E. F. ..... Carnduff, Sask.
Rice, W. M. ..... Niagara Falls, Ontario.
Roy, P. ..... Ottawa, Ontario.

Secord, J. N. ..... Thamesville, Ontario.
Simpkinson, C. H. ..... Grenfell, Saskatchewan.
Stevens, R. W. ..... Hamilton, Ontario.
Styles, H. J. ..... Arnprior, Ontario.
Sykes, D. ..... Warkworth, Ontario.

Taylor, B. S. ..... Ottawa, Ontario.
Twidale, M. A. ..... Niagara Falls, Ont.

Waite, M. J. ..... Colborne, Ontario.
Williams, A. R. ..... Oshawa, Ontario.
Wilson, B. T. ..... R.R. 2, Kerrwood, Ontario.

THIRD YEAR

Angus, D. B. ..... North Bay, Ontario.

Bain, J. R. ..... Hamilton, Ontario.
Baker, W. W. ..... Kingston, Ontario.
Barrett, L. D. ..... Salford, Ontario.
Bauld, R. H. ..... Wolfville, N.S.

Bawtenheimer, J. W. ..... Shedden, Ontario.
Bews, D. M. ..... Gananoque, Ontario.
Bissell, R. H. ..... Brockville, Ontario.
Blakely, R. A. ..... Belleville, Ontario.
Brake, E. C. ..... Hastings, Ontario.

Campbell, H. S. ..... Bryn Athyn, Penna.
Clark, J. E. ..... Kingston, Ontario.
Clarke, W. A. ..... Ottawa, Ontario.
Courtis, R. P. ..... Wallaceburg, Ontario.

Elliott, H. B. ..... Ingersoll, Ontario.
Evans, H. ..... Niagara Falls, Ontario.

Foot, J. R. G. ..... Toronto, Ontario.
Fowlie, H. R. ..... Kingston, Ontario.

Geddes, M. ..... St. Thomas, Ontario.
Gemmell, J. A. ..... White Fish, Ontario.
Grandy, A. S. E. ..... Omemee, Ontario.
Graves, H. A. ..... Kingston, Ontario.

Harper, M. F. ..... St. Thomas, Ontario.
Henderson, J. R. ..... Kingston, Ontario.
Honsberger, J. C. F. ..... Box 819, Welland, Ontario.

Ireton, J. M. ..... Moosomin, Sask.

Kirk, W. D. ..... Douglas, Ontario.

Laidlaw, D. A. ..... Wilton Grove, Ontario.
Lewis, G. ..... Aisla Craig, Ontario.
Low, R. A. ..... Ottawa, Ontario.

Mainguy, W. F. ..... London, Ontario.
Matheson, N. J. ..... Ottawa, Ontario.
Miller, W. S. ..... Fenwick, Ontario.
Milne, J. M. ..... Kingston, Ontario.
Minard, G. McR. ..... Ottawa, Ontario.
Moffat, H. S. ..... Toronto, Ontario.
Murphy, C. B. ..... Mansfield, Ontario.
Murray, V. S. ..... Powassan, Ontario.

McIlroy, H. M. ..... Hamilton, Ontario.
MacKinnon, K. A. ..... Kingston, Ontario.
Maclennan, J. S. ..... Lindsay, Ontario.
McMullen, W. B. ..... Windsor, Ontario.
McNeill, A. W. ..... Aylmer (West), Ontario.

Neilson, J. E. ..... Lyn, Ontario.
Nute, C. W. ..... Brockville, Ontario.

O'Leary, A. J. ..... Lindsay, Ontario.

Piper, R. L. ..... Calgary, Alberta.
Plewes, C. A. ..... Brockville, Ontario.

Racey, H. J. ..... Westmount, P.Q.
Reid, M. A. ..... Kingston, Ontario.
Robbins, J. V. ..... Wellandport, Ontario.
Robertson, A. E. ..... R.R. 2, Cornwall, Ontario.
Ryan, E. ..... Kingston, Ontario.

Shearer, J. L. ..... Ottawa, Ontario.
Sheppard, A. G. ..... Toronto, Ontario.
Stephens, C. L. S. ..... St. Thomas, Ontario.
Stevenson, J. G. A. ..... Niagara Falls, Ontario.

Thicke, J. E. ..... New Liskeard, Ontario.
Tweedle, W. J. ..... R.R. 1, Hannon, Ontario.

Wight, C. D. ..... Ottawa, Ontario.
Wilson, A. M. ..... Hamilton, Ontario.

Zavitz, H. B. ..... St. Thomas, Ontario.

FOURTH YEAR

Beaton, N. S. ..... Haileybury, Ontario.
Brehaut, R. C. ..... Murray Harbour, P.E.I.
Buss, C. R. ..... Thorold, Ontario.

Cox, H. ..... St. Thomas, Ontario.
Cockburn, G. D. ..... Gravenhurst, Ontario.
Coursolles, C. H. ..... Ottawa, Ontario.
Culver, D. N. ..... Orillia, Ontario.
Currey, A. R. ..... Morrisdale, N.B.

Davis, G. R. ..... Smith's Falls, Ontario.
DeLong, L. M. ..... Southampton, Ontario.
Drybrough, R. W. ..... Box 789, Sudbury, Ontario.

Ellis, J. F. ..... Fort Erie, Ontario.

Fell, J. L. ..... Box 1061, Brampton, Ontario
Findlay, J. H. ..... Kingston, Ontario.
Foster, G. J. ..... Waterdown, Ontario.

Gathercole, J. W. ..... Hamilton, Ontario.

Hamilton, J. M. ..... Vars, Ontario.
Honsberger, A. H. ..... Welland, Ontario.
Houlden, J. W. ..... Hamilton, Ontario.
Howard, J. P. ..... Eganville, Ontario.

Ide, H. M. ..... Ottawa, Ontario.

James, F. H. ..... Walkerton, Ontario.
Jenkinson, H. C. ..... Niagara Falls, Ontario.

Kilborn, R. K. ..... Toronto, Ontario.
Kincaid, D. H. ..... Perth, Ontario.
Kirkpatrick, R. A. ..... Edmonton, Alberta.
Knapp, A. C. ..... Sydenham, Ontario.

LaQue, F. L. ..... Box 326, Gananoque, Ontario.
Little, E. E. ..... Dalkeith, Ontario.
Little, J. A. ..... Allandale, Ontario.
Love, G. C. ..... Kingston, Ontario.
Lundy, C. S. ..... Box 134, Newmarket, Ontario.

MacLeod, J. M. ..... Dalhousie Station, Que.

Orange, F. A. ..... Sudbury, Ontario.
Orr, W. W. ..... Ottawa, Ontario.

Pettit, J. H. ..... Grimsby, Ontario.
Potter, A. M. ..... Kingston, Ontario.

Robinson, J. S. ..... Kingston, Ontario.

Sanderson, S. J. ..... Oxford Station, Ontario.

Thomson, W. J. ..... Orillia, Ontario.
Thurling, M. C. ..... St. Thomas, Ontario.
Timmins, A. G. ..... Pakenham, Ontario.

White, A. F. ..... Indian River, Ontario.
Willis, R. W. ..... Listowel, Ontario.
Wilson, J. L. ..... Owen Sound, Ontario.
Young, J. D. ..... Westboro, Ontario.

SPECIAL COURSE

Muirhead, A. G. ..... Carleton Place, Ontario.

M. Sc. WORK

Marion, L. E. ..... Ottawa, Ontario.
Suffel, G. G. ..... Inkerman, Ontario.

FIRST YEAR—ALL COURSES

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.		Chem. I.	Math. Lab	Phys I.	Phys. Lab. Sect. 3 Projection Sects. 1, 2 Draw. I Sect. 4	Phys. Lab. Sect. 3 Projection Sects. 1, 2 Draw. I. Sect. 4	Phys. Lab Sect. 1 Projection Sects. 3, 4	Phys. Lab. Sect. 1 Projection Sects. 3, 4
Tues.		Math. I.	English	Math. II. (a) Math. III. (b)	Chem. I. Sects. 1, 2, 3 Draw. I. Sect. 4	Chem. I Sects. 1, 2, 3 Draw. I. Sect. 4	Chem. I Sects. 1, 2, 3 Draw. I Sect. 4	Phys. Drill
Wed.		Chem. I.	Math. IV (a) Astron. I. (b)	Phys. II	Chem. I. Sect. 4 Draw. I. Sects. 1, 2, 3	Chem. I. Sect. 4 Draw. I Sects. 1, 2, 3	Chem. I Sect. 4 Draw. I Sects. 1, 2, 3	
Thurs.		Math. I (a) Math. II. (b)	English	Math. II. (a) Math. III. (b)	Draw. I. Sects. 1, 2, 3 Phys Lab. Sect. 4	Draw. I Sects. 1, 2, 3 Phys. Lab. Sect. 4	Phys. Lab Sect. 2	Phys. Lab. Sect. 2
Fri.		Chem. I.	Math. IV. (a) Astron. I (b)	Phys. I.		Surv. I	Surv. I	Engineering Society
Sat.		Phys. II	Math. Lab.	Phys. Drill				

SECOND YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.		**Phys. III.**	**Genl. I.**	**Math. V.**	**Phys. III.** **A.B.C.D.** Shop work (1) **E.F.G.** Surv. II. (2) E.F.G.	**Phys. III.** A.B.C.D. Shop work (1) **E.F.G.** Surv. II. (2) E.F.G.	**Min. I.** A.B.C.D. **Shop work (1)** **E.F.G.** **Surv. II. (2)** E.F.G.	**Min. I.** A.B.C.D.
Tues.		**Geol. I.** **A.B.C.D.** **Mech. IX.** E.F.G.	Astron II. E.F.G.	Phys. IV (a) A.B.C.D. Qual.Chem. II.(b) A.B.C.D.	**Descr. Geom. (a)** A.B.C.D.E.F.G. **Drawing II (b)** **A.B.C.D.** **Draw. III (b)** **E.F.G.**	**Descr. Geom. (a)** A.B.C.D.E.F.G. Drawing II (b) **A.B.C.D.** **Draw. III (b)** **E.F.G.**	Phys. IV. (a) A.B.C.D. **Drawing III (a)** E.F.G. Phys. IV. (b) E.F.G.	Phys. IV. (a) A.B.C.D. **Drawing III (a)** E.F.G. Phys. IV. (b) E.F.G.
Wed.		Phys. IV E.F.G. Qual. Chem.II(a) A.B.C.D.	**Min. I.** **A.B.C.D.** Qual. Chem. I. E.F.G.	**Math. V.**	Qual. Chem. II. **A.B.C.D.** Shop work (2) **E.F.G.** Surv. II (1) E.F.G.	Qual. Chem. II. **A.B.C.D** Shop work (2) **E.F.G.** Surv. II (1) E.F.G.	Qual. Chem. II. **A.B.C.D.** Shop work (2) E.F.G. Surv. II (1) **E.F.G.**	
Thurs.		**Geol. I.** **A.B.C.D.** Qual. Chem. I. E.F.G.	**Surv. III.** **A.B.C.D.** Qual. Chem. I. E.F.G.	Qual. Chem. II. **A.B.C.D.** **Surv. II.** **E.F.G.**	Surv. III. **A.B.C.D.** Mech. IX. E.F.G.	Surv. III. A.B.C.D. **Mech. IX.** E.F.G.	Surv. III. **A.B.C.D.**	
Fri.		**Phys. III.**	**Genl. I.**	Math. V.	Qual. Chem. II. **A.B.C.D.** **Phys. III.** E.F.G.	Qual. Chem. II. **A.B.C.D.** Phys. III. E.F.G.	Qual. Chem. II. **A.B.C.D.**	**Engineering Society.**
Sat.		Descr. Geom. (a) Draw. II (b) **A.B.C.D.** Draw. III. (b) E.F.G.	Descr. Geom. (a) Draw. II (b) **A.B.C.D.** Draw. III. (b) E.F.G.	Descr. Geom. (a) Draw. II (b) A.B.C.D. Draw. III. (b) E.F.G.				

Numbers in brackets indicate sections.

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.	Elect. I. A.D.E.F.(a) Met. III. Dm. (b) Math. VIII H (a)	Quant. Chem. II. **B.** Geol. II. **C.** Org. Chem. I.(a) Dc. Ry. I E (a) Mun. I. E (b) Thermo. V. F. Elect. III. G.	Thermo. I. (a) A.D.E.F.G. Genl. Chem. II. B Min. II. **C.(b)** Elect. I. A.D.E.F.(b) Phys. V. (b) G. H.	Met. II **A.B.Dm.** Min. V. C. Org. Chem. I.(a) Dc. Chem. Eng. I. (b) **Dc.** Genl. II. E. Mech. II. (b) **F.G.** **Math. VI (a)** **F.G.** Math. IX. **H.**	Genl. III. A.D.G. Ind. Chem. II **B.** Geol. Reps. C. Elect. I. E.F.	Genl. III A.D.G. Ind. Chem. II **B.** Geol. Reps. C. Elect. I. E.F.	Genl. III. E.F. Ind. Chem. II **B.** Geol. Reps. C. Elect. I. A.D.	Gen. III. E.F. Elect. I. A.D.
Tues.	German A. B.H. Hydraulics I E.F.G.	Mining I. (b) **A.** Phys. Chem. I. **B.C.D.** Hydraulics I E.F.G.	**Geol. III.** **A.C.** Ind. Chem. II. **B.D.** Met. I. E.F.G. Phys. VI. H. (a) Phys. VII. H (b)	Surv. V. (a) A.C. **Ore Dressing (b)** **A.C.Dm.** **Mech. I.** D. (a) F. G. Genl. II. **E.**	Min. IV A Phys. Chem. I. B.C.D. **Survey IV.** E. **Thermo. V.** **F.** **Elect. III.** **G.** Physics VI. H. (a) Phys. VII. H. (b)	Min. IV A. Phys. Chem. I. B.C.D. **Survey IV.** E. **Thermo. V.** **F.** **Elect. III.** **G.** Physics VI. H. (a) Phys. VII. H (b)	Phys. Chem. I. B.C.D. Surv. IV. **E.** Elect. III. **G.** Physics VI. H. (a) Phys. VII. H. (b)	
Wed.	Mech. I. D (a) F.G. Math. VIII. H. (a)	Genl. V. A.D.F.G. Quant. Chem. II. **B.** Geol. II. **C.** Surv. IV. E. (a) Mun. I. E. (b)	Met. II. **A.B.Dm.** Genl. VI **E.** **Phys. V (a)** **G.H.** Math. VII. G. **(b)** Phys. VIII. H.**(b)**	Mining I. **A.** Min. V. C. Org. Chem. I. B.Dc. Geol. IX **E.** Mech. IV F. (a) **Elect. III.** **G.** Math. IX. H.	Geol. III. A.C. (b) Quant. Chem. II. B. (a) Bateriol XII. B. (b) Mech. III. D.(a)F. Org. Chem. I (b) Dc. Ind. Chem. II. Dm. (b) Ry. I. **E.** Phys. V. G. H.	Geol. III. A.C. (b) Quant. Chem. II. B. (a) Bateriol XII. B. (b) **Mech. III.** D.(a) F. Org. Chem. I.(b) Dc. Ind. Chem. II. Dm. (b) Ry. I. **E.** Phys. V. G.H	Geol. III. A.C. (b) Quant. Chem. II. B. (a) Bateriol XII. B. (b) **Mech. III.** D.(a) F. Org. Chem. I.(b) Dc. Ind. Chem. II. Dm. (b) Ry. I. **E.** Phys. V. G. H.	Org. Chem. I (b) Dc.

THIRD YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Thurs.	German A. **B.H.**	Phys. Chem. I. **B.C.D.** Ry. I. E. Mech. IV. F.	**Min. III (a)** **A.C.** Min. IV. (b) A.C Ind. Chem. II. **B.D.** Elect. III. **G.** Phys. VI. H. (a) Phys. VII. H. (b)	Ore Dressing A.C.Dm. Chem. Eng. I. Dc. (b) Geol. IX. E. Elect. II. G.H.	Quant. Chem. I. **A.C.D.H.** Quant. Chem. II. B **Mech. III.** **F.** **Mech. VII.** **G.**	Quant. Chem. I. **A.C.D.H.** Quant. Chem. II. **B.** **Mech. III.** **F.** **Mech. VII.** **G.**	Quant. Chem. I. **A.C.D.H.** Quant. Chem. II. B **Mech. III.** **F.** **Mech. VII.** **G.**	Quant. Chem. I. **A.C.D.H.**
Fri.	Min III. (a) **A.C.** Quant. Chem. I. Dc. (b) Math. VIII. H. (a)	Thermo I. (a) A.D.E.F.G. Thermo II (b) F.G. **Geol. II.** **C.** Quant. Chem. I. Dc. (b) Phys. XIV. **B. (a)**	Elect. I. A.D.E.F. Phys. XIV. **B. (a)** **Min. II.** **C. (b)** **Math. VII.** **G. (b)** **Phys. VIII.** **H. (b)**	Org. Chem. I. B. Dc. Min V. C. Struct, I. E. Math. VI. (a) F.G. Mech. II. (b) **F.G.** Math. IX. **H.**	Quant. Chem. II. B Min. IV. A.C. (a) Genl. VI. E.	**Genl. V.** **A.D.F.G.** Quant. Chem. II. **B.** Geol. and C. Genl. VI. E.	**Genl. V.** **A.D.F.G.** Quant. Chem. II. **B.** Min. Reps. C. Genl. VI. E.	
Sat.	**Fire Assay (b)** **A. Dm.** German A. **B.H.**	**Fire Assay (b)** **A.Dm.** Org. Chem. I **B.** **Surv. V. (a)** **A.C.** Ind. Chem. II. Dm. (a) Dc. Struct. I. E. Shop Work **F** Elect. II. G.H.	**Fire Assay (b)** **A.Dm.** Org. Chem. I **B.** **Surv. V. (a)** **A.C.** Ind. Chem. II. Dm. (a) Dc. Struct. I. **E.** Shop Work **F.** **Elect. II.** **G.H.**	**Fire Assay (b)** A.Dm. Org. Chem. I **B** **Surv. V. (a)** **A.C.** Ind. Chem. II. Dm. (a) Dc. **Struct. I.** **E.** Shop Work **F.** **Elect. II.** **G.H.**				

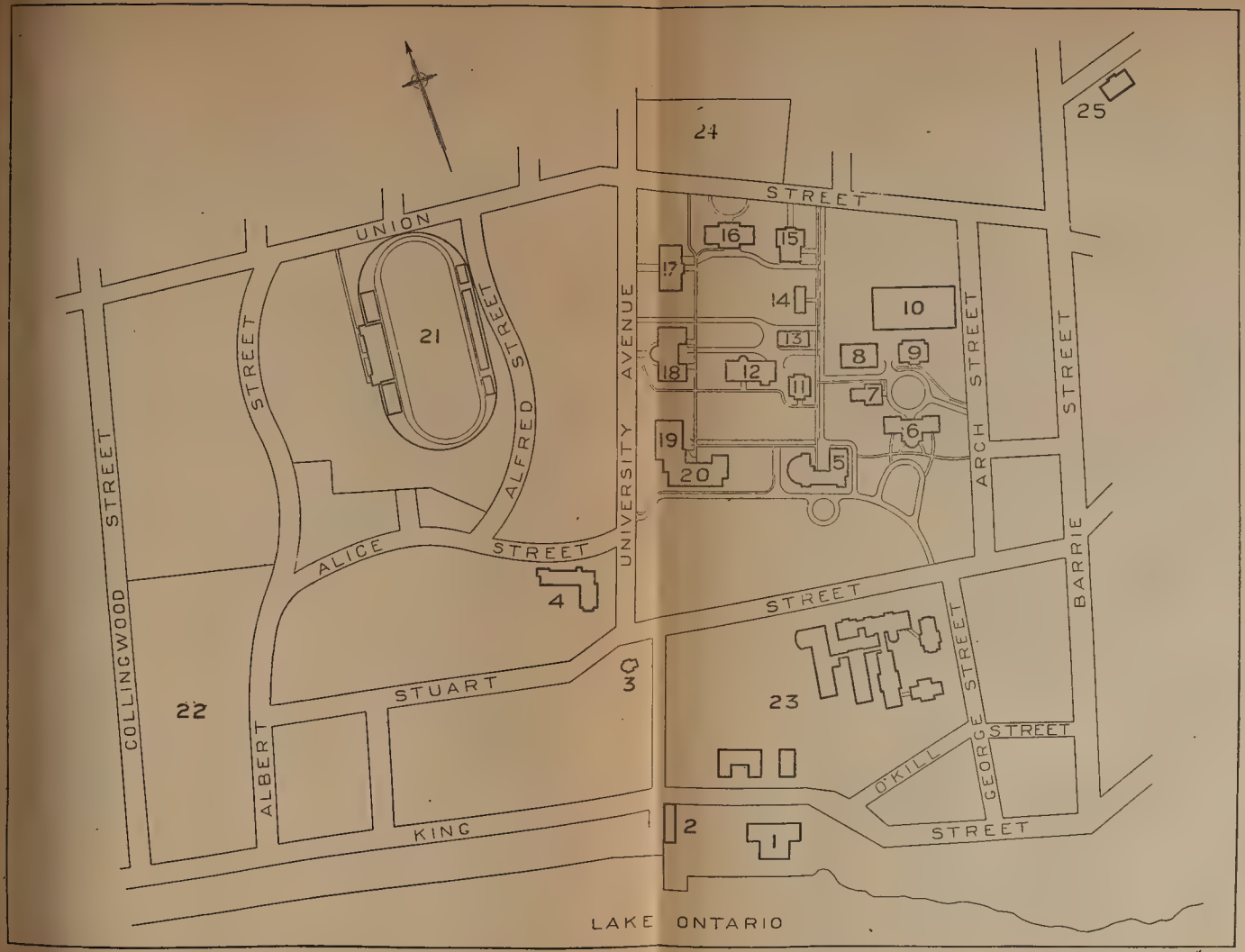
	VIII.	IX.	X.	XI	I.	II.	III.	IV.
Mon.	Mining II. A. German 3 (a) B.H.	**Econ. I.** A.B.C.D. E.F.G.H.	**Geol. VIII.** **A.C.** Phys. Chem. II. **B.D.** Highway E. (a) Mun. II **E (b)** **Thermo. III.** **F.G.**	**Mining II.** **A.** Ind. Chem. III. B. (a) Phys. Chem. III B. (b) **Met. II.** **C.Dc.** Mun. III. **E.** Hydraulics II **F.** Elect V. G. Phys. IX. H. (a) Phys. XI. H. (b)	**Mining III.** **A.** Ind. Chem. III. B. (a) Coll. Chem. B. (b) Mining IV C. Dm. Chem. Eng. III. **Dc.** Strut II. E. **Mech. V.** **F** Elect. VIII. G. **Phys. XIII.** **H.**	**Mining III.** **A.** Ind. Chem. III. B. (a) Coll. Chem. **B. (b)** Geol. VII. **C.** Chem. Eng. III. **Dc.** Strut II. **E.** **Mech. V.** **F.** Elect. VIII. G. **Phys. XIII.** **H.**	**Mining III.** **A.** Ind. Chem. III. B. (a) Coll. Chem. B. (b) Geol. VII. **C.** Chem. Eng. III. **Dc.** **Mech. V.** **F.** Elect. VIII. **G.** **Phys. XIII.** **H.**	Chem. Eng. III. **Dc.**
Tues.	German A. **C.** Met. V. (b) Dm. Strut II. E. (a) Math. X. H. (a) Math. XI. H. (b)	**Met. IV.** **A.Dm.** Chem. Reps. **B.** Geol. VI. **C.** Struct. IV E. Mech. VI. F. (a) Mech. XI. F. (b) Elect. VIII G.H.	Mech. IV. (a) **A.D.E.** Hydr. I. (b) A.D. Genl. Chem. III. **B.** Biol. **C. (a)** Strut II. E. (b) **Mech. V.** **F.** **Elect. V.** **G.**	Geol. VIII A.C. Org. Chem. II. **B.** Met. V (a) Dm. Met. VI. (b) Dm. G. Chem. Eng. III. Dc. (a) Ore Dressing (b) **Dc.** Ry. II. **E.** Thermo. III. F.G. Phys XII. H. (a) Phys. X. H. (b)	**Mining II.** **A.** **Chem. Opt.** **B.** Geol. Theos. **C.** **Struct. III.** **Dc.** Met. VII. Dm. Ry. II. **E.** Mech. V. F. Elect. X G.	**Chem. Opt.** **B.** Geol. Theos. **C.** **Struct. III.** Dc. Met. VII. Dm. Ry. II. **E.** Mech. V. F. **Elect. X.** G.	**Chem. Opt.** **B.** Geol. Theos. **C.** **Struct. III.** **Dc.** Ry. II. **E.** Mech. V. F. **Elect. X.** **G**	

FOURTH YEAR

	VIII	IX	X.	XI.	I	II	III	IV
Wed.	Mining IV. (a) C.Dm. Met VI. (b) Dm. G. Geol. V. (b) A.C. German 3 (a) B.H.	**Econ. I.** A.B.C.D. E.F.G.H.	Ind. Chem. I. **A.E.F.** **Met. II.** **C.Dc.** Elect. XII G.H.	**Met. IV.** A.Dm. **Chem. Reps** **B.** Min. VI. C. Chem. Eng. II. **Dc.** **Highway** E (a) Mun. II. E. (b) Mech. V. **F.** **Elect. X.** **G.** Phys. IX. H (a) Phys. XI. H. (b)	**Mining III.** **A.** Org. Chem. II. B. (a) Phys. Chem. III B. (b) Geol. Thes. **C.** Chem. Eng. II. **Dc.** **Met. Lab. II.** **Dm.** **Struct. IV.** **E.** Elect. VII. F. Thermo. III. G. **Phys. XIII.** **H.**	**Mining III.** **A.** Org. Chem. II. B. (a) Phys. Chem. III B. (b) Geol. Thes. **C.** Chem. Eng. II. **Dc.** **Met. Lab. II.** **Dm.** **Struct. IV.** **E.** Elect. VII. **F.** Thermo. III. **G.** **Phys. XIII.** **H.**	**Mining III.** **A.** Org. Chem. II. B. (a) Phys. Chem. III B. (b) Geol. Thes. **C.** Chem. Eng. II. **Dc.** **Met. Lab. II.** Dm. Struct. IV. **E.** Elect. VII. **F.** Thermo. III. **G.** **Phys. XIII.** **H.**	
Thurs.	Hydr. I. A.D. German A. **C.** Math. X. H. (a) Math. XI. H. (b)	**Mech. IV.** **A.D.E** Geol. VI. C. **Hydr. II.** **F.** Elect. XII. G.H.	Hydr. I. (b) A.D. Geol. VIII. (b) A.C. **Biol. II.** **C. (a)** Genl Chem. III. **B.** Chem. Eng. III. Dc. (b) Eng. Econ. **E.** Mech. VI. **F.** **Elect. V.** **G.**	**Met. IV.** A.Dm. Org. Chem. II. B. **Ore Dressing** **Dc.** Strut. II. E. Mech. V. **F.** Phys. XII. H. (a) Phys. X. H. (b)	Phys. Chem. II. **B.D.** Geol. Thes. **C.** Highway E. (a) Mun. II. III. E. (b) **Elect V.** G.	Phys. Chem. II. **B.D.** Geol. Thes. **C.** Highway E. (a) Mun. II. III. E. (b) **Elect V.** G.	Phys. Chem. II. **B.D.** Geol. Thes. **C.** Highway E. (a) Mun. II. III. E. (b) **Elect V.** G.	

FOURTH YEAR

	VIII	IX	X.	XI	I	II	III	IV
Fri.	**Milling** **A.Dm.** **Chem. Opt.** **B (b)** German 3 (a) B.H. **Hydraulics II** E. G. Met. VIII. F. (a)	**Milling** **A.Dm.** **Chem. Opt.** **B. (b)** Chem. Eng. III. **Dc.** Hydr. II. E.G. Met. VIII. F. (a) Mech. XI. F. (b)	**Milling** **A.Dm.** **Chem. Opt.** **B. (b)** Chem. Eng. III. **Dc.** **Struct. IV.** **E.** **Thermo. IV.** **F.**	**Milling** **A.Dm.** Phys. Chem. III. B. (b) Ind. Chem. III. B. (a) Chem. Eng. II **Dc.** Struct. IV. E. Thermo. IV. F. Elect. V. G. Phys. IX. H. (a) Min. VI. C.	**Milling** **A.Dm.** Org. Chem. II. B. (b) Genl. Chem. III. B (a) Shop work (a) Dc. Met. Lab. I. (b) **Dc.** Strut. II. E. **Thermo. IV.** **F.** **Elect V.** **G.** **Phys. XIII.** **H.** Geol. Thes. **C.**	**Milling** **A.Dm.** Org. Chem. II. B. (b) Genl. Chem. III. B (a) Shop work (a) Dc. Met. Lab. I. (b) Dc. Strut. II. E. **Thermo. IV.** **F.** **Elect V.** **G.** **Phys. XIII.** **H.** Geol. Thes. C.	**Milling** **A.Dm.** Org. Chem. II. B. (b) Genl. Chem. III. B (a) Shop work (a) Dc. Met. Lab. I. (b) Dc. Strut. II. E. **Thermo IV.** **F.** **Elect V.** **G.** **Phys. XIII.** **H.** Geol. Thes. C.	Engineering Society
Sat.	Phys. Chem II. **B.D.** German A. **C.** **Fire Assay** **C (b)** Math. X. **H. (a)** Math. XI. H. (b)	**Milling** **A.** Org. Chem. II. **B.** **Fire Assay** **C. (b)** Struct. III. **Dc.** Metallography Dm. Thermo. III F. (a) **Mech. VIII.** **F. (b)** Elect. XII. (b) G. H.	**Milling** **A.** Org. Chem. II. **B.** **Fire Assay** **C (b)** Metallography **Dm.** **Genl. IV.** E. (a) Hydr. III. E (b), G (a) Thermo. III F. (a) **Mech. VIII.** **F. (b)** Elect. XII. (b) G. H.	**Milling** A. Org. Chem. II. **B.** **Fire Assay** **C (b)** Metallography Dm. **Genl. IV.** E. (a) Hydr. III. E (b), G (a) Thermo. III F (a) **Mech. VIII.** F. (b) Elect. XII. (b) G. H.				



DEPARTMENT OF DRAWING

PLAN OF QUEEN'S UNIVERSITY GROUNDS

1. Central Heating Plant.
2. Hydraulic Laboratory.
3. Observatory.
4. Ban Righ Hall, Women's Residence.
5. Theological Hall, Biological Laboratories, Museum and Convocation Hall.
6. Principal's Residence.
7. Anatomy and Pharmacology Buildings.
8. Gymnasium.
9. Medical Laboratories.
10. Jock Harty Arena.
11. Carruthers Hall (Civil Engineering).
12. Fleming Hall (Electrical Engineering).
13. Mining Laboratory (Mill).
14. Mechanical Laboratory.
15. Nicol Hall (Mining and Metallurgy).
16. Gordon Hall (Chemistry).
17. The Douglas Library and Administration Offices.
18. Ontario Hall (Physics, Geology and Mineralogy).
19. Grant Hall.
20. Kingston Hall (Arts Building).
21. The George Richardson Memorial Stadium.
22. The Leonard Field.
23. Kingston General Hospital and Richardson Laboratories.
24. Site of Students' Union.
25. Old Collegiate Building.

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